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C. A. Soper

The Evolution of Suicide

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To Hattie, Mo, and Fred.

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Glossary of Abbreviations and Neologisms

CMDs	Common mental disorders (Goldberg & Goodyer, 2005)
EP	Evolutionary psychology (Buss, 2005)
fender	Front-line, active, anti-suicide, evolved psychological mechanism
ID	Intellectual disability (Lunsky, Raina, & Burge, 2012)
keeper	Last-line, reactive, anti-suicide, evolved psychological mechanism
SSSD	Self-serving self-deception (Paulhus & Buckels, 2012)

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Chapter 1
Introduction

> *To understand suicide is one of the absolutely fundamental and puzzling challenges of the human condition.* (Maris, 1981, p. 339)

This book seeks to explain the evolutionary origins of suicide – how deliberate, intentional self-killing came to be part of the behavioural repertoire of the human species.

There are, of course, many intellectual domains from which to approach suicide as a topic (Nock, 2014; Shneidman, 1989). Philosophers have grappled with the motivations and ethics of self-killing at least since the schools of Pythagoras and Plato, and the question of whether life is or is not worth living remains, according to Camus (1955), the only truly serious philosophical problem. Cultural historians and anthropologists have charted humanity's diverse and shifting attitudes towards suicide – sometimes approving, but more often abhorrent (Colt, 1991; Fedden, 1938). The sociologist Emile Durkheim (1897/1952) chose suicide as the subject of a monograph with which he aimed to assert the credentials of sociology as a scientific discipline, a work which remains seminal today. Psychological theories of suicide have been put forward at least since the time of Freud (1917/1964), primarily in search of more effective ways to tackle suicide as a clinical and public health problem (Gunn & Lester, 2014; Selby, Joiner, & Ribeiro, 2014). Today, branches of neurobiology and genetics spearhead the natural sciences' efforts to understand the behaviour (Dwivedi, 2012; Turecki & Brent, 2016). This inquiry's focus on an evolutionary perspective is not to suggest an incompatibility with, or to diminish the value of, these alternative directions of research: indeed it draws upon many for its theoretical and empirical material. Rather it is to highlight the fact that, for evolutionists, suicide presents a specific and as yet unresolved scientific puzzle: how it is that an organism could have evolved by natural selection with the capacity wilfully, and yet for no apparent biological purpose, to kill itself (Aubin, Berlin, & Kornreich, 2013; Confer et al., 2010).

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1.1 Definition of Suicide: Deliberate, Intentional Self-killing

Notwithstanding the scientific context, suicide carries a commonplace meaning for the purpose of this book: *deliberate, intentional self-killing* (Ivanoff, 1989; WHO, 2014).

Although outwardly simple, such a definition hides complications and calls for some provisos. There is, first, the question of what constitutes the intended self-killing. While the discrete outcome of death is of primary interest to statisticians tracking completed suicides for epidemiological purposes (Silverman, 2013), Shneidman (1989, p. 28), from a clinician's perspective, observes that cessation, rather, is the suicide's salient intent – specifically, that "the common goal of suicide is cessation of consciousness." He writes:

> …once the idea of cessation crosses into consciousness, the suicidal act has begun. The idea of cessation – that you can be free if all your problems, get out of this mess, cancel your debts, release yourself from this anguish, stop this disease – is the turning point in the suicide drama. (Shneidman, 1980, p. 13)

Shneidman's psychological perspective has empirical support and broad currency in suicidology (Leenaars, 2017) – a field which he effectively founded – but it implies *inter alia* that a suicide attempter's view of "successful" self-killing, an ending of consciousness, may not necessarily tally with a medical or statutory definition of death (Youngner, Arnold, & Schapiro, 2002).

Second, the notion of intent is both central to the idea of suicide and highly problematic, inasmuch as perhaps all studies in suicide must take a view on what are ultimately unknowable states of mind: did the suicide really mean to take his own life? How would we know? Suicidal people often have ambivalent intentions – what proportion of the intent should be suicidal for an act to count as suicide (Maris, Berman, & Silverman, 2000)? Suicidologists have sought technical definitions of suicide that avoid direct reference to intention, but the implication of intent resides nonetheless (Andriessen, 2006; De Leo, Burgis, Bertolote, Kerkhof, & Bille-Brahe, 2006; Fairbairn, 2003; Silverman, Berman, Sanddal, O'Carroll, & Joiner, 2007). To keep its scope manageable, this study takes the pragmatic position that a death can be taken as suicide if self-killing (i.e., the permanent cessation of consciousness), rather than some other goal, is presumed to have been the primary objective of the act. The first of three specific exclusions follows from this stance: there is no attempt, at least directly, to deal with the unusual but topical phenomenon of suicide terrorism. Rather, for our purposes, if cessation of consciousness is viewed as the primary purpose of the act, with the deaths of others being an incidental side effect, then no special explanation may be required: suicide terrorism in this case can be viewed as suicide (Lankford, 2013). Alternatively, if cessation of consciousness is not the primary objective of the act but is rather a concomitant of some other goal, such as the murder of others by a bomb, or the achievement of a supposedly better consciousness in an afterlife, then the act is not suicide by this book's definition and

falls outside of its scope.[1] Second, by the same criterion, the rare phenomenon that Durkheim (1897/1952) termed altruistic suicide — exemplified, he thought, in deeds of battlefield heroism— is also set aside for the purpose of this discussion (Johnson, 1965). Third, the incidental deaths of insects and non-human animals that may follow from their sometimes self-sacrificial efforts to defend territory or escape entrapment are also excluded. The question of supposed animal suicides will be discussed further in a later section.

As a further exclusion, there is no aim to formulate an evolutionary account of mass suicide – like suicide terrorism, an exceptional but high-profile phenomenon – which probably involves an unusual and special set of conditions and processes (Mancinelli, Comparelli, Girardi, & Tatarelli, 2002; Meerloo, 1962). The focus of this investigation is personal, solo, self-killing – what Cholbi (2017) calls "run-of-the-mill" suicide. A theoretical explanation might emerge which may incidentally help to account for mass suicides, acts of terrorism, and other forms of homicide, but that is not its primary objective. More will be said about research goals later in this chapter.

1.2 Suicide as an Evolutionary Puzzle

A brief introduction to Darwin's theory of natural selection will serve to justify the premise that suicide constitutes an evolutionary puzzle. Darwin's idea has its roots in Thomas Malthus's (1798) notion of the tension between the finite resources available to an organism and its indefinite capacity to procreate: if left unchecked, organisms reproduce at a geometric rate, their populations multiplying eventually to exhaust the available nutrients and other resources. Sooner or later, a point is reached at which not all offspring can stay alive, and at this stage, according to Darwin, a relentless struggle to survive and reproduce ensues, a struggle for which some organisms are better equipped than others. If an organism bequeaths to its offspring a heritable trait that gives them an advantage in the struggle, then that trait will gradually spread across the entire population. In the opposite direction, any heritable trait that disadvantages the reproductive prospects of an organism's progeny will be duly eradicated. Natural selection works to the same rule that plant and animal breeders follow to mould the features of domesticated species. Unifying both natural and artificial selection, as Darwin explained, there is just "one general law, leading to the advancement of all organic beings, namely, multiply, vary, let the strongest live and the weakest die" (Darwin, 1859/1996, p. 198). This principle, as developed by biologists, palaeontologists, and geneticists in the first half of the twentieth century (Huxley, 1942/1963; Mayr & Provine, 1980), is accepted today across mainstream science as the only credible explanation for the ordering of life, and all life,

[1] Suicide terrorism may not present so neat a dichotomy: acts of martyrdom may integrally entail an intention to kill both self and others (Liddle, Bush, & Shackelford, 2011; Sela & Shackelford, 2014; Townsend, 2014).

on earth (Dobzhansky, 1973; Mayr, 1982; Williams, 1966, 1996). But if natural selection axiomatically entails the survival of the fittest (Darwin, 1868),[2] how then to explain the success of an organism that, as a phenotypic trait, can opt out – thereby deselecting itself from the struggle?

Some might argue that suicidality does not need, or is not amenable to, an evolutionary explanation and that it falls outside of the scope of Darwinian theory. Perhaps the emergence of human freewill and culture renders the laws of nature inapplicable (Dennett, 2003). Human behaviour, modified by the cultural transmission of ideas, is clearly characterised by a remarkable degree of freedom from biological constraints (Kitcher, 1985; Sahlins, 1976; Slobodkin, 1978). Perhaps Darwinism is no more relevant to suicide than it is to other dysgenic practices such as contraception, celibacy, or adoption, behaviours which demonstrate not the supremacy of genetic selection but the flexibility of human behaviour and the self-transmitting nature of ideas – or, to use the term coined by Dawkins (1976), memes. Following trajectories of their own, memes can spread across a population sometimes in direct conflict with the reproductive interests of individuals' genes (Blackmore, 1999). The meme for planned childlessness, for example, comparable to suicide – "a reversal of the fundamental strategy of all life" (Dennett, 1995, p. 330) – has propagated itself widely. A suicide meme too might be communicable, as evidenced by the clusters of imitative suicides that sometimes follow high-profile exemplars (Kral, 1994; Marsden, 1998; Stack, 2003). The notion that suicidality may be exempt from Darwinian processes may be valid to an extent, but only inasmuch as it acknowledges that different levels of analysis – proximate, ultimate, and others – can be brought to bear on any biological trait (Symons, 1979; Tinbergen, 1963). While proximal mechanisms may explain how a maladaptive cultural practice may provisionally prevail, in the long run, culture can be expected to adjust towards maximising reproductive success (Harris, 1974; Whiten, Hinde, Laland, & Stringer, 2011). To use Lumsden and Wilson's (1981) metaphor, genes hold culture on a leash. There are disputes about the nature and elasticity of the leash, and it may be hard to discern at times what is pulling what. Memes and genes may be best understood as co-evolving, as with the genes that confer lactose tolerance, for example, that have apparently spread in populations that practice dairying (Feldman & Laland, 1996). But in any conflict, so Lumsden and Wilson (1981) argue, genes are the final arbiters. To illustrate, it is easy to understand the immediate appeal of contraception and to accept that the practice may loosen the grip of natural selection for a while (Laland, Odling-Smee, & Myles, 2010), but at some stage, a group shrunken by such a "race-destroying vice" (Fisher, 1930/1958) would eventually be expected to give way to more fertile populations. At an ultimate level, the study of learned behaviours cannot be entirely sealed off from biological science not least because

[2] "This preservation, during the battle for life, of varieties which possess any advantage in structure, constitution, or instinct, I have called Natural Selection; and Mr. Herbert Spencer has well expressed the same idea by the Survival of the Fittest. The term 'natural selection' is in some respects a bad one, as it seems to imply conscious choice; but this will be disregarded after a little familiarity" (Darwin, 1868, p. 6).

our capacities for behavioural flexibility and the acquisition of cultural ideas are themselves evolved faculties (Tooby & Cosmides, 1992).[3]

In sum, it is hard to see how suicidality could remain indefinitely immune from selective pressures: at some point, self-destructive individuals and groups would expectably be supplanted by the more self-preserving. There is an intuitive logic in the argument made by Farber (1980) that suicide ought to operate as one of natural selection's most powerful agents, weeding out the psychologically weak from the breeding population. It is a view traceable to Darwin himself in one of his rare and passing comments on the subject: "Melancholic and insane persons … commit suicide," he writes, to illustrate how "some elimination of the worst dispositions is always in progress even in the most civilised nations" (Darwin, 1879/2004, p. 162).

And yet there is a reason to believe that the human capacity for suicide is not only ultimately constrained by natural selection but is positively born of it. At least three observations point in this direction.

1.2.1 Variability, Heritability, and Differential Fitness Effect of Suicide

First, suicidality appears to offer the three handles – variability, heritability, and a differential effect on reproductive fitness (Darwin, 1859/1996) – by which natural selection would be expected to gain purchase, systematically favouring the offspring of the less suicidal. Variability can be seen in the contrasting propensities for suicidal behaviour that prevail across different individuals, cultures, nations, and ethnic groups (De Leo et al., 2013; Nock, Borges, & Ono, 2012b; Värnik, 2012; WHO, 2014). Across the countries of Europe, for example, rates vary spatially by an order of magnitude (Schmidtke, 1997; Voracek, Loibl, & Kandrychyn, 2007) in a persistent pattern of differentials that caught Durkheim's (1897/1952) attention more than a century ago. This unevenness seems to have a heritable component: suicide runs in families, and apparently not just because of learned behaviours and shared family

[3] E. O. Wilson argues a case for accepting suicide, or rather the mind that can contemplate suicide, as ultimately a biological phenomenon from a philosophical stance at the beginning his book, *Sociobiology*:

"Camus said that the only serious philosophical question is suicide. That is wrong even in the strict sense intended. The biologist, who is concerned with questions of physiology and evolutionary history, realizes that self-knowledge is constrained and shaped by the emotional control centers in the hypothalamus and limbic system of the brain. These centers flood our consciousness with all the emotions – hate, love, guilt, fear, and others – that are consulted by ethical philosophers who wish to intuit the standards of good and evil. What, then, made the hypothalamus and limbic system? They evolved by natural selection. That simple biological statement must be pursued to explain ethics and ethical philosophers, if not epistemology and epistemologists, at all depths. Self-existence, or the suicide that terminates it, is not the central question of philosophy. The hypothalamic-limbic complex automatically denies such logical reduction by countering it with feelings of guilt and altruism. In this one way the philosopher's own emotional control centers are wiser than his solipsist consciousness, "knowing" that in evolutionary time the individual organism counts for almost nothing." (Wilson, 1975, p. 3)

upbringings. Twin and other studies in behavioural genetics report that some 30% to 55% of variability in suicide risk may be attributed to heritable factors (Fiori, Ernst, & Turecki, 2014; Roy, Nielsen, Rylander, & Sarchiapone, 2000; Voracek & Loibl, 2007), reducing to about 17% after setting aside the overlapping heritability of certain psychiatric conditions (Turecki & Brent, 2016).[4] There are critics of the soundness of behavioural genetic methodologies and of the meaningfulness of heritability measures in human psychology generally (e.g., Joseph, 2001; Lewontin, 2011; Loehlin, 2010; Rose, Lewontin, & Kamin, 1984; Sarkar, 1998), as well as warnings voiced within the field of genetics about the validity of claimed genetic explanations for complex human traits (Turkheimer, 2000). But nonetheless, even allowing for an arguable inflation in some findings, the consensus among suicidologists is that there is a significantly heritable component to suicidality (Baldessarini & Hennen, 2004; Brent & Mann, 2005; Dwivedi, 2012; Fiori et al., 2014; Goldney, 2003b; Lin & Tsai, 2016; Mann & Currier, 2010; Marušič & Swapp, 2004; Turecki & Brent, 2016; Voracek & Loibl, 2007; Zai et al., 2012). That marked heritability should be found in a trait as self-destructive as suicide calls for an explanation, because even a minimally disadvantageous effect on reproductive fitness ought to be enough to drive a heritable trait out of a population. Keller and Miller (2006) advise that an allele (variant gene) would be subject to natural selection in a sizable breeding population on the strength of a fitness coefficient of only 0.003% – equivalent to just one offspring more or fewer than average in 15 generations. Putting this minimal rate into perspective, Roy (2001) observes that Margaux Hemingway's suicide in 1997 was the fifth suicide among four generations of Ernest Hemingway's family, a familial clustering of suicidality that is apparently not unusual (Roy & Segal, 2001; Roy, Segal, Centerwall, & Robinette, 1991).

Taken together, the apparent variability, heritability, and differential fitness effect of suicide risk suggest that the levers exist by which natural selection could do the expected thing – to produce proportionately more offspring from the less suicidal, with the eventual result of eradicating the behaviour. That natural selection has not done so suggests that some countervailing evolutionary mechanism or mechanisms has actively sustained suicidality in the human population. As Darwin (1859/1996) first explained, a trait will endure in a population only if it is held in place by pressure of natural selection. A characteristic that brings no selective advantage to the organisms that have it can be expected to go the same way as the legs of snakes and the tails of human primates – to disappear.

1.2.2 Universality of Suicide

Second, we can infer that the potential for suicidality has been so maintained in the human species since primordial times from the ubiquity of the trait. It may be impossible to prove by exhaustive survey the universality of suicide, or of any

[4] This does not mean, as the point can be easily misread, that, say, 43% of suicides are caused by genes but rather that 43% of the deviation from mean suicide risk in the studied population may be heritable.

other behaviour for that matter (Brown, 1991, 2004), but it can be said that, as far as it is known, no human culture is entirely free from the phenomenon (Desjarlais, Eisenberg, Good, & Kleinman, 1995; Mishara, 2006; Zilboorg, 1936). Notwithstanding a lack of reliable statistics from many countries, Durkheim (1897/1952) deduces that suicide probably occurs everywhere on the basis of the footprint it leaves in ubiquitous legal and cultural prohibitions: as he points out, whether suicide is currently observable or not, it must have been a sufficiently pressing problem to have attracted and sustained societal concern. Suicide prevails as a temporal as well as a spatial fixture: references to self-murder have been found in a 4,000-year-old Egyptian poem (van Hooff, 1990) and in literature through every historical era since (Colt, 1991; Fedden, 1938; Mishara & Tousignant, 2004). Not only is suicidality itself apparently universal, so are the risk factors: although the suicide rate varies between nations, its correlates show a remarkable cross-national consistency (Bromet, 2012; McLean, Maxwell, Platt, Harris, & Jepson, 2008; Nock et al., 2008, 2009). Econometric models point to the existence of natural levels of suicide in human populations, above zero even if known social and economic risk factors could be adjusted to the most favourable settings (Andrés & Halicioglu, 2011; Goldney, 2003a; Lester & Yang, 2005; Yang & Lester, 1991, 2009): analogous to the existence of a natural rate of unemployment, the implication is that an underlying incidence of suicide is a normal condition of human societies. These modern statistical findings echo those of Durkheim (1897/1952): observing no social conditions under which zero suicides can be expected to occur, he infers that suicide prevails as a "necessary imperfection" – a "social fact." Many researchers have come to the view that some level of suicidality probably comes with the territory of being human (Baechler, 1975/1979; Fox, 1971; Maris, 1981; Stengel, 1964), an assessment reflected in an acceptance in some quarters that, while some suicides may be prevented, the complete elimination of suicide can be set aside as an unrealistic goal (O'Connor, Platt, & Gordon, 2011).

Suicide's ubiquity over time and place allows a tentative inference to be made about its evolutionary origins: a behaviour that occurs globally was almost certainly already universal among the original Palaeolithic humans that dispersed from Africa (Behar et al., 2008; Underhill et al., 2000), thereafter spreading with migrations, whether directly by a genetic commonality, or a cultural continuity, or both (Antweiler, 2015). The occurrence of suicide today in small-scale, pre-literate, and hunter-gatherer societies provides supportive evidence of its ancient roots (Brown, 1986; Hezel, Rubinstein, & White, 1985; Jollant, Malafosse, Docto, & Macdonald, 2014; Macdonald, 2007; Reser, 1990; Tousignant, 1998; Zilboorg, 1936): for a trait to recur among these closest observable analogues to ancestral human societies suggests that it is no mere product of modern, urban lifestyles, but that it rather follows a continuous line of descent from our ancient forebears (Kappeler, Silk, Burkart, & van Schaik, 2010). Suicide probably emerged among humans in the primeval past and, for reasons as yet unclear, has endured.

1.2.3 Suicide as a Species-Specific Human Behaviour

Third, suicide appears to be a uniquely human behaviour (Comai & Gobbi, 2016; Maltsberger, 2003; Preti, 2005). Non-existence of evidence is, of course, not the same as evidence of non-existence, but it is telling that, while animal suicides feature widely in mythology, folklore, and anecdote, no scientifically reliable account of actual suicide among non-humans has yet surfaced. This void in the record remains despite at least three forces which can be expected to have brought evidence of non-human animal suicide to light, if it exists. Firstly, the vast number of potential observations may be considered. There have been countless opportunities over the centuries, around the globe, for humanity's cumulative millions of breeders, farmers, and naturalists to have observed and documented the phenomenon of non-human suicide, if indeed it occurred (Preti, 2007, 2011b). Secondly, the silence holds despite an active and long-standing academic and scientific search for evidence of animal suicide, both in the field and the laboratory. In the field, observations by O'Connor (1978), after modelling the conditions of starvation in which a burdensome nestling might theoretically be expected to sacrifice itself for the sake of inclusive fitness – to aid the survival of the genes it shares with its stronger siblings – found that in reality a nestling will let its entire brood starve rather than preemptively volunteer to die. In the laboratory, more than a century of experiments have likewise evidenced no actual non-human suicides. Many scorpions, for example, were burned alive by Victorian investigators seeking to demonstrate the then popular idea that scorpions sting themselves to death when faced with inevitable death by fire (Ramsden & Wilson, 2010) – in vain not least because, as is now known and presumably for reasons of natural selection, scorpions are resistant to their own venom (Legros, Martin-Eauclaire, & Cattaert, 1998). Schaeffer (1967) devised half a century ago a laboratory experiment designed to establish whether an animal could be induced to kill itself, but there are no reports of positive results arising from his experimental design – or from any other, for that matter (Lester, 2014b). Thirdly, the record remains mute despite strong commercial motivations in favour of finding cases of non-human suicide: if discovered, an animal model of suicide would be expected to attract keen interest from the pharmaceutical industry for the possibilities it could create for testing the suicidogenic or protective effects of drugs (Comai & Gobbi, 2016; Malkesman et al., 2009; Preti, 2011a). Others may also be motivated to document animal suicide, if it exists, for its popular journalistic value: illustrating the pressure to produce such a story, the myth of lemming suicide appears traceable largely to a 1958 documentary, *White Wilderness*, the makers of which, having failed to find actual cases of lemmings voluntarily leaping into the sea, are reported to have thrown captive animals off a cliff to obtain the desired footage (Chitty, 1996; Woodford, 2003).

To be clear, certain eusocial species – non-breeding castes of hymenopteran insects, snapping shrimp, naked mole rat, and possibly others – are often ready to sacrifice their individual somas in the genetic interests of their colonies (Joiner, Buchman-Schmitt, Chu, & Hom, 2017). Animals can certainly injure themselves,

usually as a side effect of defending territory (Crawley, Sutton, & Pickar, 1985), and perhaps most noticeably under exceptionally stressful conditions in captivity (Jones, 1982; Jones & Daniels, 1996). Animals may eventually die from the resulting wounds (Goldney, 2000, 2001; Jones, 1982; Lester & Goldney, 1997). But it is hard to argue that such attendant deaths, occurring incidentally in the pursuit of other goals, constitute the intentional, deliberate cessation of consciousness that defines suicide at least for the purpose of this analysis (Goldstein, 1940; Preti, 2011b).

The apparent specificity of suicide to the human species together with its universality indicates that suicidality arose at or after the juncture of speciation – the divergence of human evolution from that of our closest extant primate relations. The curiosity is not just that the capacity for suicide should have evolved in the first place but that it has remained with us: observing that suicidality has apparently not been eliminated in any part of the world, we can infer that some process of natural selection has actively maintained the trait and presumably continues to do so. An evolutionary explanation is called for.

1.3 The Fitness Costs of Death and Suicide

Suicide, an apparently variable, heritable trait, presents an evolutionary puzzle because to be dead, and to be dead by one's own hand especially, would appear to incur a severe fitness cost.

1.3.1 The Fitness Cost of Death

It is true that, while organisms may usefully be viewed as survival machines (Dawkins, 1976), it is not survival for its own sake that natural selection favours: the Darwinian rule of thumb – survive and reproduce – reminds us that evolutionary success requires reproduction, not just survival. But for most organisms, most of the time, future reproduction is predicated on staying alive now. There are exceptions: organisms that breed only once in a lifetime, for example, may indeed reproduce at the cost of their own survival, as is the case with certain male spiders that are eaten by their mates after copulation. But usually, for reproductive purposes, as Duntley & Buss (2004) put it, it is "bad to be dead": an organism's death by whatever cause usually brings with it multiple and serious problems for the future propagation of its genes.

First, most obviously, the dead can no longer reproduce: death guarantees that the most direct means by which an individual's genes can be transmitted is permanently closed off. Huxley (1942/1963) distinguishes between those selective pressures that promote survival and others that promote reproduction, and he provides a commonsense reason why survival selection is generally the more powerful force: while reproduction selection affects the size of a clutch, survival selection affects whether there is a clutch at all.

Second, if there are already offspring then, for humans perhaps more than other animals, a parent's untimely death tends to throw severe obstacles in the way of those progenies' own prospects for raising future generations. Some of the human handicaps of a parent's death are itemised by Duntley (2005), starting with the repercussions of the deceased's inability further to contribute to a child's or grandchild's safe upbringing. Into adulthood, bereaved descendants may find it harder to secure a place in society, to select high-quality mates, and to raise children of their own. Lacking a co-parent's support, and with his or her own survival needs to prioritise, the remaining partner may be poorly resourced to care for the deceased's surviving young. What resources are available may be diverted into new mating relationships: if a new relationship begins, then the dead person's children may find themselves at the mercy of a stepparent with competing genetic interests. At an apparently heightened danger of neglect, abuse, or homicide, a stepchild's position may be perilous (Daly & Wilson, 1988). The general disadvantage incurred by children as a result of a parent's death may be a cross-cultural outcome: in tribal societies, for example, children raised without fathers tend to be less popular and to die younger (Geary, 2005). For orphans, the prospects are predictably harsher: poverty, exploitation, abuse, and neglect can be found the world over, even, or perhaps especially, in traditional societies (Bailey, 2009). That the disadvantages of being bereaved recur in pre-literate societies suggests that such adversities are no mere novelty of modern cultures and might expectably have prevailed deep into human prehistory.

Third, more widely, death ends an individual's ability to support his extended family – relations who, by dint of inclusive fitness (Hamilton, 1964) could indirectly propagate the individual's genes through their reproduction. Wider still, Duntley (2005) notes the potential for power struggles, disrupted family networks, and other complications that can impair the reproductive prospects of an entire kin group in the wake of an individual's death.

1.3.2 The Fitness Cost of Suicide

If in evolutionary terms it is bad to be dead, to be dead by suicide appears to be even worse, due to the added psychological and social penalties imposed on surviving kin (Andriessen, Rahman, Draper, Dudley, & Mitchell, 2017; Bolton, Au, Leslie, & et al., 2013; Carter & Brooks, 1991; Cerel, Fristad, Weller, & Weller, 1999; Dunne, Dunne-Maxim, & McIntosh, 1987; Erlangsen et al., 2017; Jordan, 2001; Jordan & McIntosh, 2011; Mishara, 1995; Parker, 2014; Pitman, Osborn, King, & Erlangsen, 2014; Sveen & Walby, 2008; Wilcox, Mittendorfer-Rutz, Kjeldgård, Alexanderson, & Runeson, 2015). For those bereaved by suicide, economic hardship and rejection by the community are commonplace outcomes (Grad, 2011; Healey, 1979; Poole, 1985). One effect of strong social mores against at least some forms of suicide – a disapprobation found across human cultures (Fedden, 1938) – is that the families of suicides tend to receive less social support than those bereaved in more socially acceptable ways (Akotia, Knizek, Kinyanda, & Hjelmeland, 2014; Chapple,

Ziebland, & Hawton, 2015; Jordan, 2001; Knizek, Kinyanda, Akotia, & Hjelmeland, 2013; Macpherson & Macpherson, 1985; Wertheimer, 2014). In many traditional cultures, self-killings are viewed as the work of evil spirits (Akin, 1985; Macpherson & Macpherson, 1985; Mishara & Tousignant, 2004) with commensurately dark consequences for surviving kin. Mugisha, Hjelmeland, Kinyanda, and Knizek (2011), observing the severe social distancing faced by Baganda tribespeople bereaved by suicide, record disinheritance, the severing of the suicide's lineage, the ritual destruction of their homes, exile, and other punishments. The emotional effects for children bereaved by suicide can be particularly severe, including guilt, blame, and confusion about responsibility for the death, a heightened risk of mental illness, and a greater likelihood of themselves dying by their own hands (Cain & Fast, 1966; Calhoun, Selby, & Selby, 1982; Carter & Brooks, 1991; Cerel & Aldrich, 2011; Jordan, 2001; Pitman et al., 2014; Range & Calhoun, 1990; Turecki & Brent, 2016). In his analysis of the ethics of suicide, Hook (1927) concludes that the strongest argument against taking one's own life is that it is simply cruel.

1.3.3 The Fitness Cost of Suicide as a Basis for a Bargaining Hypothesis

So dire are the economic, social, and emotional sequelae of suicide for the surviving kin and community that suicide is often interpreted – and routinely misinterpreted (Bancroft et al., 1979; Hawton, Cole, O'Grady, & Osborn, 1982; Valach, Young, & Michel, 2011) – as an interpersonal rather than a private act. Suicides are sometimes deemed to be motivated by a desire to exact revenge or to manipulate others (Brown, 1986; Canetto, 2008). Indeed, Syme, Garfield, and Hagen (2016) posit, and explore with cross-cultural data, a bargaining hypothesis — that an evolutionary impetus for suicide, or at least for attempted suicide, may lie in its extortion value. The suggestion is that a suicide attempt constitutes a drastic Machiavellian gamble, consciously or unconsciously taken by the otherwise powerless individual – modally, by a young uneducated woman (Nock et al., 2008) – and aimed at coercing others to improve her lot (Hagen, 2003). The gamble pays off if she survives and gets what she wants, but to lose is to die. There is some empirical and theoretical support for the idea: a "cry for help" component in suicidal behaviour has long been recognised (Nock, 2008; Shneidman & Farberow, 1961b; Williams, 1997), in part reflecting the characteristic ambivalence of the suicidal state of mind – people may simultaneously determine to die but also hope to be rescued (Shneidman, 1985). It has also long been clear that completed suicide (the focus of this study) and attempted suicide (the focus of the bargaining model) are to some extent distinct behaviours, undertaken by separate populations, with distinguishable motives and epidemiologies (Hawton & van Heeringen, 2000; Shneidman & Farberow, 1961a; Stengel, 1964): while non-fatal suicide attempts are made more often by the young and females, actual suicides are more often completed among the old and males, and there are other differences *inter alia* in the lethality of the methods used.

There are, on the other hand, at least six problems with an evolution-informed bargaining model of suicide. First, for a suicide threat to be credible on the basis of its inclusive fitness logic, the victim of the blackmail would need to believe that it would actually be in the blackmailer's genetic interests to carry out the threat. It is hard to imagine a real-life scenario by which this outcome could arise: a ploy by which, say, a bride threatens her father with suicide to forestall an arranged marriage might work on fitness grounds only if the father assessed the marriage as being so certain to annihilate her prospects of producing any viable offspring, within or outside of that marriage, or of helping her kin to raise their children, that she may as well die now – otherwise, bluff would expectably be called.

Second, it is hard to see how a psychological device that would arrive at a supposedly fitness-maximising suicide threat could have evolved. Modern evolutionary theory holds that such a high-level generalised fitness-maximising mechanism is unlikely to come about, because natural selection operates, rather, on the basis of specific informational cues that, in our ancestral environment, helped to solve particular, recurring, fitness problems (Tooby & Cosmides, 1990b). That we are not equipped with a generalised urge to spread our genes or with a measuring instrument that, taking everything into account, would inform such an urge is belied, among many other contraindications, by the use of recreational drugs, widespread participation in extreme sports, the practice of voluntary childlessness, and Symons's (1992) observation that sperm banks do not attract queues of would-be donors.

Third, while it is notoriously difficult to discern the intentions behind suicidal acts, sometimes even for the actors themselves (Andriessen, 2006), the main source of evidence for extortion as an alleged motive for suicide – other peoples' opinions and hearsay – is particularly unreliable (Hjelmeland, Dieserud, Dyregrov, Knizek, & Leenaars, 2012). Culturally loaded meanings and messages are perhaps bound to be read into self-killing if only on account of the act's deviancy and extraordinary social impact (Counts, 1991; Knizek & Hjelmeland, 2007; Lester, 2014a). Folk interpretations abound: supernatural forces are often opined by non-Western and tribal informants as causing suicide (Hezel et al., 1985; Mugisha, Hjelmeland, Kinyanda, & Knizek, 2013; Syme et al., 2016; Tousignant, 1998),[5] mystical explanations that would arguably be as evidentially well supported by third-party accounts as putative interpersonal motives. It is telling, however, that the causes presumed by others for suicides are frequently at odds with the actors' own accounts (Bancroft et al., 1979; Hawton et al., 1982; Michel & Valach, 2001; Valach et al., 2011): observers often (mis)judge suicides to be gestures or manipulations, while suicide attempters themselves – whether in person after a failed attempt (Boergers, Spirito, & Donaldson, 1998; Bowles, 1985; von Andics, 1947) or in their suicide notes (Chávez-Hernández, Leenaars, Chávez-de Sánchez, & Leenaars, 2009; Chávez-Hernández, Paramo, Leenaars, & Leenaars, 2006; Gunn, Lester, Haines, & Williams, 2012; Meyer, Irani, Hermes, & Yung, 2017; O'Connor, Sheehy, & O'Connor, 1999) – are more likely to explain their own actions as a desperate escape from an intolerably painful situation. Suicide notes indeed frequently contain messages of

[5] Some would argue that psychiatric explanations for suicide favoured in Western cultures are no less mythological (Hjelmeland, 2013; Linehan, 2008).

remorse and apologies that seek to absolve other people of blame (Meyer et al., 2017).

Fourth, survey evidence suggests that in practice, suicides usually offer little scope for a round of bargaining: significant others are unlikely to find out about suicide attempts even after the event, let alone get prior warnings. Brezo et al.'s (2007) longitudinal study of a cohort of 1,715 adolescents in Quebec found parents were unaware, four times in five, of their children's history of attempted suicides, or at least claiming to be unaware. It seems that those at highest risk of attempting to take their own lives are those least likely to offer opportunities for intervention (Berman, Jobes, & Silverman, 2006).

Fifth, suicidality appears to be universally accompanied by intense emotional pain (Shneidman, 1993; Troister & Holden, 2012; Verrocchio et al., 2016), and it is unclear why this particular affective link should hold if suicide attempts were aspirational gambits: lifestyle-changing inheritances, high-value mates, or other fitness-enhancing ransoms could as plausibly be demanded with menaces in other mood states – the excitement intrinsic to gambling perhaps (Wulfert, Franco, Williams, Roland, & Maxson, 2008).

Finally, empirical counter-evidence against the notion that attempted suicides can look forward to fitness payoffs lies in the typically, and predictably, unrewarding social reactions actually experienced by those who try but fail to kill themselves: they can expect to win little sympathy and few concessions that would come close to compensating for the extreme fitness costs and risks involved – the prospect of death or of permanent disability from a failed suicide attempt (Brown, 1986; Hawton et al., 1982; Knizek et al., 2013).[6]

On this basis, while a bargaining hypothesis might help to elucidate some unintended deaths, it would seem to be an unsatisfactory basis for an evolutionary account of deliberate, intentional self-killing. Nonetheless, a bargaining hypothesis of suicide is instructive: that it can be plausibly posited at all illustrates the central point being made here that suicide not only terminates the individual's prospects for direct reproduction, but it also predictably and seriously disadvantages the suicide's kin. From an evolutionary standpoint, there remains a need to reconcile the tenets of natural selection and inclusive fitness with this particularly dysgenic human propensity.

1.4 Epidemiology and Theory of Suicide

Suicide is not rare. It may appear exceptional from an individual's perspective, as might be said of death generally – suicide reportedly occurs at an annual rate of "only" about 11.4 per 100,000 population globally (WHO, 2014) – but it is far from an uncommon cause of mortality. No less than 1.4% of all deaths are attributed to

[6] Illustrating the scale of the gap between the mortal fitness risk taken in a suicide attempt and the questionable bargain value of its supposed fitness rewards, the latter posited in Syme et al. (2016) include "swayed parents" and, perhaps most oddly, "prevented ear modification."

suicide, some 800,000 per year, which makes it the world's leading cause of violent fatality: more people die by self-murder than by wars and homicide combined (WHO, 2012a, 2014). The real incidence may be higher, with perhaps a fifth of suicides going unreported in official statistics (Kapusta et al., 2011; Rockett, Kapusta, & Bhandari, 2011): such is the stigma that often surrounds suicide that many cases are misclassified as deaths by other or unknown causes (Tøllefsen, Hem, & Ekeberg, 2012). Actual deaths can be viewed as the tip of an iceberg of suicidality: it is estimated that for each completed suicide, there are 20–25 "unsuccessful" attempts (Troister, 2014) and that 2.7% of people in the world have tried to take their own lives at some stage, 0.4% over a 12-month period alone (WHO, 2014). Reported rates of suicidal ideation very widely: an international study found that 10–18% of the general population reported having had suicidal thoughts at some stage (Weissman et al., 1999); towards a higher end of results, a survey of shoppers in Seattle found that 53–67% admitted to have seriously considered suicide at some stage, 20% in the past year alone (Linehan, Goodstein, Nielsen, & Chiles, 1983).

1.4.1 Correlates and Unpredictability of Suicide

A large body of empirical data has accumulated concerning the factors that correlate with suicide risk. It is known, for example, that suicidal behaviours are more common among people with a history of previous suicide attempts (Haglund, 2015); with mental disorders (Nock et al., 2015); who are female, younger, unmarried, and unemployed (Nock, Deming, et al., 2012); who are experiencing feelings of hopelessness (Davidson & Wingate, 2013); with certain neurochemical characteristics (Dwivedi, 2012) and genetic predispositions (Zai et al., 2012); and so on. Indeed, empirical studies have confirmed hundreds of disparate danger signs and risk factors (Tucker, Crowley, Davidson, & Gutierrez, 2015). Figure 1.1 shortlists more than 30 risk factors in the psychological domain alone, as identified by O'Connor and Nock (2014). Frustratingly, however, and despite decades of concerted research, no combination of variables has yet been found that usefully predicts where suicide is likely to strike (Borges et al., 2012; Chang et al., 2016; Haney et al., 2012; Hawgood & De Leo, 2016; Large et al., 2016). In clinical settings, some 95% of those assessed as high risk do not commit suicide, while a bulk of actual suicides occur among supposedly low-risk patients (Carter et al., 2017; Mulder, Newton-Howes, & Coid, 2016). Nor do statistical associations in themselves provide an account of the processes and causalities involved or indicate what to do about them. A recent World Health Organization report acknowledges that "we continue to lack a firm understanding of why, when, and among whom suicidal behavior will occur" (Nock, Borges, & Ono, 2012a, p. 222).

A better understanding is urgently sought. Preventing suicide has been accepted as a major public health challenge across the world (Satcher, 1999; WHO, 2014), and a clinical and research effort has been directed at the problem over many

Personality & individual difference	Cognitive factors	Social factors	Negative life events
• Hopelessness • Impulsivity • Perfectionism • Neuroticism and extroversion • Optimism • Resilience	• Cognitive rigidity • Rumination • Thought suppression • Autobiographical memory biases • Belongingness and burdensomeness • Fearlessness about injury and death • Pain insensitivity • Problem solving and coping • Agitation • Implicit association • Attentional biases • Future thinking • Goal adjustment • Reasons for living • Defeat and entrapment	• Social transmission • Modelling • Contagion • Assortive homophily • Exposure to deaths by suicide of others • Social isolation	• Childhood adversities • Traumatic life events during adulthood • Physical illness • Other interpersonal stressors • Psychophysiological stress response

Source: O'Connor and Nock (2014)

Fig. 1.1 Some key psychological risk and protective factors for suicidal ideation and behaviour

decades. Reliable data on global suicides are hard to obtain, with most World Health Organization member states unable to provide good-quality vital statistics (WHO, 2012b). One recent report suggests the global suicide rate has fallen by 26% during the 12 years to 2012, although the reasons for this movement are unknown (WHO, 2014): a previous report pointed to a 45% increase over a 45-year period (Yip et al., 2012). While mankind has apparently made strides in reducing other forms of violent death (Pinker, 2011), it may be that the global rate of suicide is no lower now than it was 50 or 100 years ago (Linehan, 2006, 2011; Nock, Borges, Bromet, et al., 2012). There are some indications of progress (Bertolote & De Leo, 2012) and occasional reports of effective therapies among high-risk groups (e.g., Ellis, Rufino, Allen, Fowler, & Jobes, 2015). Nonetheless, the aggregate of interventions appears to be largely ineffectual, with little headway being made (Kessler, Berglund, Borges, Nock, & Wang, 2005; Nock et al., 2012a).

Understandably the call is not just for more research but for the identification of fresh directions for research (Rogers & Apel, 2010; Silverman, Pirkis, Pearson, & Sherrill, 2014). There are formidable obstacles: researchers in suicidology face an array of special logistical, methodological, and ethical difficulties (Prinstein, 2008). But the main obstacle to progress, in the opinion of some leading workers, is the continuing lack of a comprehensive, generally accepted conceptual model by which to understand suicide and to make sense of the data (Lester, 2000b; Rogers & Lester, 2010; Van Orden et al., 2010). Joiner (2000), a prominent suicidologist, writes of a theoretical vacuum in suicidology, evidenced by the perennial influence of Durkheim

(1897/1952) – a pioneering researcher cited a few times already in this chapter. Durkheim's proposal – that the highest suicide rates are found in extreme conditions of societal integration or deregulation – endures after more than a century as one of suicidology's principal theories (Selby et al., 2014) and as a basis for empirical research, but not, in Joiner's view, because of its exceptional utility, but rather for want of anything more interesting. Durkheim's model may indeed be disputed by most researchers in the field, but then no other theory attracts a consensus either (Saint-Laurent, 2003).

1.4.2 Recent Developments in Suicide Theory

The theoretical vacuum has begun to be filled in recent years with three new strands of thinking that may lead to progress. First, some theorists draw attention to an important and categorical difference between suicidal thoughts and suicidal deeds – notably Klonsky and May (2015), who give credit in turn to the Integrated Motivational-Volitional model of R. C. O'Connor (2011) and the Interpersonal-Psychological Theory of Suicide (IPTS) originally formulated by Joiner (2005). Their common stance is an "ideation-to-action" framework (Klonsky & May, 2014; Klonsky, Saffer, & Bryan, 2017), which acknowledges that, while many people think seriously about suicide at some point in their lives, and while around a third of these ideators do go on to attempt suicide (Nock et al., 2008), most do not. The epidemiological data suggest that thought and deed may not be entirely continuous phenomena: the risk factors usually associated with suicidality, such as depression and most other mental illness (Nock et al., 2008), psychological pain, and feelings of hopelessness (May & Klonsky, 2013), correlate with suicidal thoughts better than they correlate with the enactment of those thoughts – for suicidal thoughts to translate into suicidal deeds, a separate set of influences come into play (Dhingra, Boduszek, & O'Connor, 2015; May & Klonsky, 2016). Illuminating how different drivers of risk associate with different stages in the progression, Klonsky and colleagues propose a three-step theory: step 1 of their model sees suicidal ideation arising from any kind of physical or emotional pain combined with a hopeless inability to foresee any relief from the pain. As step 2, ideation will intensify if the pain is not outweighed by an ongoing connectedness – someone or something that constitutes a strong enough reason to stay alive. A suicide attempt, step 3, occurs only if the individual has the practical and mental wherewithal to carry it out (Klonsky & May, 2015; Klonsky, May, & Saffer, 2016).

A second new focus of research connects with one of the implications of the ideation-to-action framework, that the path to suicide is guided not just by conditions that promote risk but also by protective counterforces that block the way. With a few exceptions (e.g., Linehan et al., 1983) and perhaps understandably, researchers have tended to focus on the drivers of suicide, at the expense of neglecting other elements that may have a life-preserving effect. O'Connor (2011) and J. Johnson et al. (2008, 2010, 2011) are among those leading a correction of this imbalance, examining the

attitudinal, cognitive, and other personal characteristics associated with resilience in the face of stressors.

While both these developments no doubt help to focus attention on, and refine an understanding of, the correlates of suicidality, their major limitation is that they are agnostic with regard to the causal processes that underlie the correlations. Most theoretical approaches in suicidology focus on collections of risk factors – some distal/predisposing (e.g., genetics, parasite infestation), some developmental (e.g., early-life adversities, personality traits), and others proximal or precipitating (e.g., mental disorders, access to means) (Turecki & Brent, 2016). It remains unexplained as to why a certain blend or sequence of risk factors should produce specifically suicide, as opposed to other deviant behaviours. The specificity of suicide persists as a conceptual missing link, a gap noted decades ago by Atkinson (1978):

> As is usual with almost all post-Durkheimian studies of suicide, it is nowhere spelled out precisely how the independent variable (be it social integration, status integration, lack of external restraint or whatever) is linked with the dependent variable (suicide rates). In other words, a characteristic feature of such works…is the failure to explain why suicide in particular, rather than some other course of action, is a likely consequence of the particular structural condition posited as the independent variable. (1978, pp. 14–15).

It may be that a third recent development in suicide theory may help to break the impasse: a fresh attempt to understand the evolutionary roots of suicide may help to take the knowledge of correlational associations forward into an understanding of the causal processes. The appearance of certain evolutionary ideas in some recent proposals indicates a recognition that any comprehensive, coherent theory of suicide needs to fit, alongside other domains of life science, within the modern Darwinian paradigm of evolutionary biology (Aubin et al., 2013; Gunn, 2017). Evolutionary issues in suicide became a point of discussion in the 1980s, led by the exploratory writings of deCatanzaro (1980, 1981, 1982, 1986), but his ideas have gained little traction. Working independently and building on the work of Paul Gilbert (Gilbert, Price, & Allan, 1995), Mark Williams (1997) incorporated into his "Cry of Pain" model of suicide two types of adaptive behaviours observed in non-human animals as possible pointers to the evolutionary origins of suicidogenic depression among humans. One is the attitude of pre-emptive defeat that animals often adopt to avoid conflict with more powerful conspecifics. The other is what Dixon, Fisch, Huber, and Walser (1989) label "arrested flight" – a defensive depressed-like behaviour exhibited by animals when trapped or unable to escape from threats. Most recently, Joiner et al. (2016, 2017), in papers that reference some of deCatanzaro's (1980) ideas, tentatively draw analogies with the sometimes self-sacrificial, yet evolutionarily explicable, behaviours of social insects and other animals, with a view to explaining maladaptive suicidality in humans. One strength of these publications is their agenda-setting acknowledgement that suicide and evolution theories should connect, an acceptance perhaps of geneticist Dobzhansky's (1973) axiom that "nothing in biology makes sense except in the light of evolution." The common weakness of these evolutionary hypotheses, it may be argued, lies in their reliance on putative animal analogues to this end: as already discussed, evidence of actual non-human suicide is signally missing. Biological processes that convincingly

explain, say, insect behaviour may at best be only suggestive of hypotheses about human suicide: a distinctively human evolutionary account is required to explain what appears to be a uniquely human problem. Such a specifically human explanation of suicide has yet to be fully worked out.

Hence, the opportunity and need arise for a new model of suicide which integrates recent advances in the understanding of suicide's epidemiological correlates and which places suicide within an evolutionary paradigm specific to the human species. To meet this need is the hope and aim of this volume.

1.5 Aims of the Book

This book will attempt to formulate a coherent, evolutionary explanation for the emergence of suicide that may provide a tentative starting point for other researchers. There is no expectation of achieving a definitive account; rather, in a Lakatosian spirit, the aim is to offer a preliminary approximation (Ketelaar & Ellis, 2000; Lakatos, 1976). This being a scientific project, the hope is to arrive at a theoretical framework that fulfils traditionally accepted criteria by which scientific theories generally are assessed. Accepting that science has yet to agree on an exhaustive specification of these criteria, Kuhn (1977) selects five that, in his view, are sufficiently important and varied to cover the consensus view. First, accuracy: the consequences deducible from a good theory should agree with existing empirical findings. Second, consistency: a good theory should be integrated both within itself and externally with the accepted theories of other related domains. Third, breadth of scope: the deducible consequences of a good theory should reach far beyond the explananda the theory was formulated to target. Fourth, simplicity: a good theory should bring order to what would otherwise be viewed as unconnected phenomena and relationships. Fifth, fruitfulness: a good theory should lead the way to novel research findings, disclosing phenomena and relationships that were previously unknown or unrecognised. The outcome of this study will be assessed against these standards as part of the conclusions (Sect. 8.2 below), but the point can be made meanwhile that whatever conclusions are reached, there may well not be unanimity among readers about their worth. While his chosen criteria for preferring one theory over another may well constitute common ground across the sciences, Kuhn (1977) points out that their application by scientists as individuals is not entirely an objective matter. The need for value judgements arises from the imprecision and mutual conflicts inherent in the criteria themselves, opening the way to divergent views on their interpretation and their relative weights.

Different stances may be taken, for example, on the importance of the power of a theory to explain already known observations relative to its predictive fruitfulness. For example, a theory's predictiveness – its ability not only to generate novel empirical findings but also to predict them precisely *a priori* – features as one of four general principles selected by the entomologist Wilson (1998) as the main qualities he believes scientists look for (alongside, in his list, parsimony, generality, and

consilience). Psychologists Haig and Durrant (2000), on the other hand, argue that prediction as a criterion for theory evaluation, while widely accepted, is probably overemphasised: of greater significance are a theory's coherence, simplicity, and – aligning with the views of Thagard (1992) – explanatory breadth. A successful theory, they suggest, is judged in practice not so much by its capacity to predict new observations but, perhaps less dramatically, according to whether it better explains known data than rival theories do – an inference to the best explanation (Harman, 1965). The relative merits of explanatory breadth and predictiveness in the assessment of theory may be especially pertinent in the field of suicidology where, as already suggested, the primary call is for a conceptual framework by which to make sense of the large body of data that has already accumulated. That said, the book will also aim, as Urbach (1974) puts it, to stick its neck out, by making predictions that would permit falsification at least in principle (Popper, 1935/2002).

Specifically to the field of suicide, O'Connor (2011) describes five principles that he sought to fulfil in his formulation of the Integrated Motivational-Volitional model, success criteria which will also help as a guide:

> …the model (1) despite being grounded within the psychological literature should be interdisciplinary; (2) should build upon other theoretical models which have existing empirical support; (3) should be able to differentially predict suicidal ideation and behaviour; (4) should yield testable hypotheses; and (5) should point to avenues for potential intervention and prevention. (O'Connor, 2011, p. 186)

1.6 The Use of Intuitive Argument and Other Methodological Issues

1.6.1 Interdisciplinary Issues

Picking up on the first of O'Connor's aims, this inquiry will necessarily be interdisciplinary in its sources, drawing on and synthesising ideas and findings from diverse but overlapping domains, including evolutionary biology, psychology, psychiatry, philosophy, neurobiology, sociology, anthropology, ethology, and, of course, suicidology – itself an interdisciplinary field. It will be open too to the possible utility of illustrations from literary and religious writers where they illuminate suicidality and other aspects of human experience from a first-person, phenomenological perspective (Jesiolowski & Rogers, 2013): these may be unconventional inputs for a scientific discourse but may sometimes be the best, or only, sources available – a point that highlights one immediate epistemological problem, of defining "best sources" for a venturesome, cross-disciplinary study of this nature. A danger arises from the scope for the researcher, knowingly or not, to cherry-pick evidence that fits a preconceived end: such intellectual dishonesty is not wittingly the agenda of this researcher, but how to be sure? A formal, medical-style, systematic review – an approach that might ordinarily be adopted to safeguard against bias, based on an

explicit, systematic strategy for synthesising a body of research evidence (Khan, Kunz, Kleijnen, & Antes, 2003) – appears unworkable in the current context, in part because of the wide-ranging and emergent state of the subject. The evolution of suicide is touched upon only tangentially and parenthetically in most of the scattered literature that discusses the matter: it is the primary focus of only a handful of tentative speculations by even fewer authors. It is hard to conceive of an explicit methodological strategy that would usefully apply across the entirety of the background material either – authors as disparate as Darwin, Kuhn, and the World Health Organization, already cited. The plan is to be pragmatic: to lean on literature that is seminal or at least respected in its field, to reflect carefully at each stage of the argument, and, at key lemmas, to cross-check with multiple lines of evidence from independent perspectives. None of the main planks of the argument should rest on single supports.

There are other practical difficulties inherent in investigations that draw material from multiple domains. It is difficult for a lone researcher reliably to cover all the ground, to keep abreast of fluid developments, and indeed adequately to understand so many unfamiliar disciplines with often esoteric content. Linked to the latter challenge is the problem of communicating between different academic communities: scientists trained in a discipline become accustomed to a certain vocabulary, methodological approach, and style of presentation that may be perverse to those outside (Pellmar & Eisenberg, 2000). Notably, the very word "suicide" carries different meanings in different fields: in biology it is often used to describe processes of cellular development, as in "The ability to commit suicide is a fundamental property of animal cells" (Raff, 1998, p. 119). Clearly the word is meant to be taken metaphorically in such contexts because suicide, for the purpose of this inquiry, refers to deliberate, intentional self-killing, and presumably a cell cannot deliberate or intend anything, let alone terminate its own consciousness. The use and exploration of metaphors can help to drive scientific progress (McMullin, 1984), but there are pitfalls. As Symons (1992, p. 40) cautions, "ordinary words used in new scientific ways come trailing clouds of ordinary meanings, hence the possibility of confusion, especially when the old associations are strongly emotional."[7] Suicide, a particularly emotion-laden term, presents particular scope for confusion. It is easy to read "suicide" as metaphorical shorthand when it describes programmed cell death, but when the word is applied to an organism – a bee, rather than a cell of a bee – the metaphor can become blurry. In zoology, the word "suicide" often arises in the description of the sometimes self-sacrificing behaviours of sterile castes of hymenopteran insects, already discussed, and other eusocial species, not literally murdering themselves but reacting in defence of their colonies within an algorithm of inclusive fitness (e.g., Bourke, 2008; Shorter & Rueppell, 2012; Williams & Williams, 1957). To mix technical and common

[7] Symons (1992) draws particular attention to the scope for misunderstanding in the use of word "altruism" in genetics and sociobiology: "altruism" in these contexts relates entirely to the propagation of genes, whereas such genetic self-interest has nothing to do with altruism in the ordinary sense.

parlance in this way is to invite confusion. The categorical, often overlooked genetic distinction between insect behaviours and actual human suicide is that, while a human death extinguishes the individual's genetic material, as Dawkins (1976, p. 172) points out, "the death of a single sterile worker bee is no more serious to its genes than is the shedding of a leaf in autumn to the genes of a tree." Hamilton (1980) likewise explains:

> A worker honeybee is not committing suicide when it stings a bear on the nose, pulls away its stinger, and loses its life, any more than a lizard is doing so when its tail breaks away in the extreme emergency of an attack. Energy is gone, but reproductive potential remains if the evasive tactic is successful. Suicide of a biological individual is not involved. (1980, p. 279)

For the same reason, to describe the behaviours of social insects and humans as equivalently "self-destructive" may encourage misunderstanding, as it may be to mix two categorically different "selfs" – the "self" relevant to the genetic purpose of insect behaviour often being not the individual organismic unit, but the colony, operating as a superorganism (Emerson, 1939; Seeley, 1989; Wilson & Sober, 1989). Thus, it may not be entirely helpful that entomologists' ideas of self-destructive and suicidal behaviours, transferred across domains, have apparently come to dominate evolutionary perspectives of literal suicidality among human beings (deCatanzaro, 1980; Joiner et al., 2016, 2017). The general point illustrated by such semantic cross-purposes is that, while this book seeks to make the arguments clear and accessible for the general reader, it probably contains language, ideas, and arguments drawn from one domain that readers from another may find unfamiliar and even objectionable: there is likely something here for everyone to disagree with, depending in part on the reader's research tradition. As Kuhn (1977) argues, scientists' preferences for one theory over another, even though broad selection criteria may be shared, are inevitably coloured by individual biographical backgrounds.

Developing a further point arising from the communication difficulties inherent in multidisciplinary research, and as Proulx (2013) and others observe, it is possible to see a repeated relearning (or, rather, not learning) of previous generations' findings, partly as a result of proliferating nomenclatures: as Smolensky describes, "different disciplines are continually rediscovering one another's discoveries, because they all have different names for them" (Pellmar & Eisenberg, 2000, p. 43). Suicidology is not free of this tendency to repackage (Lester, 2000b), and nor is evolutionary psychology – psychiatrists from a Jungian background may describe as an archetype (Stevens & Price, 2000) what evolutionary psychologists would call an evolved psychological mechanism (Shackelford, 1997). Where possible, this book seeks to trace and acknowledge original sources, on which basis no apology is made for the age of some of the apparently dated works referenced.

The investigation seeks to synthesise ideas from three domains in particular: evolutionary biology, philosophy, and evolutionary psychology, each introducing its own methodological issues, discussed in turn.

1.6.2 Evolutionary Biology

First, dealing centrally as it does with evolutionary matters, this book must pass primarily as a work of biological science. Its main framework is that of evolution by natural selection, based on the ideas of Charles Darwin (1859/1996) as they have been integrated with twentieth-century developments in genetics to form what has become known as the neo-Darwinian or modern synthesis (Huxley, 1942/1963). The evolutionary principles on which this inquiry must be based, outlined above (Sect. 1.2) and elaborated in later chapters as required by each stage of the investigation, are matters of general scientific consensus: inferences will be drawn from this start point. Biologists do of course differ among themselves on many issues. One particular bone of contention is a decades-old dispute concerning the standard of evidence that should be required before a biological characteristic may be safely judged to be an adaptation – an adaption being "a trait that enhances fitness and that arose historically as a result of natural selection for its current biological role" (Lauder, 1996, p. 61). The disagreement is discussed further below (Sect. 1.6.4) in relation to psychological adaptations specifically, but it is hoped that the general conflict zone may be navigated with the help of the seminal writings of George Williams (1966, 1996). Adaptation, argues Williams, is an onerous concept – a biological trait should not be taken to be an evolved adaptation without critical attention to evidence of its design by natural selection. Design, a word frequently appearing in the following pages, is of course meant metaphorically – there is no suggestion of a teleological trajectory or of a literal designer with *a priori* outcomes in mind.[8]

1.6.3 Philosophy

Second, this will be a philosophical inquiry as well as a scientific one, in the Quinean naturalistic tradition that holds philosophy and science to be continuous domains (Haug, 2014). The continuity is partly historical, all branches of science having originated from branches of philosophy and none having entirely freed itself from philosophical content (Rosenberg, 2011). The continuity is also methodological: both science and philosophy have the examination of reality as their primary interest, and both are subject to experiential, *a posteriori* checks (Papineau, 2014; Roland, 2014). The intuitive philosophising in this volume constitutes a necessary adjunct to the empirical record: it represents a pragmatic effort to bridge gaps in the scientific data and to take a reasoned view on what could be and what would be, rather than on what is. The word "would" will frequently appear, alluding to an expectable outcome, inferred often in the absence of, or ahead of, direct empirical

[8] Dennett (2013) wishes the word "designoid" was available to describe biological patterns that have every appearance of design but are produced by automatic, blind processes.

support. There appears to be no alternative but to use this kind of armchair inquiry, as may generally be the case for the discovery of facts about possibility and necessity (Levin, 2015). Much of "what is" in connection with this particular research topic is anyway patently unknowable in an absolute sense, because of an incorrigibility intrinsic to both human evolution and suicide. As Sober (2008) points out, time is often the enemy of knowability – only the sparsest indirect sources remain to evidence the course of human prehistory (Kinzey, 1987; Klein & Edgar, 2002). The death of primary witnesses is another enemy: suicide implies an intentional self-killing, but, as has been noted already, it may be impossible to know for sure the true intentions of the deceased (Andriessen, 2006; Prinstein, 2008). The intuitive theorising that is necessary and integral to this investigation lays the entire venture open to being dismissed as speculation. A counterargument would concur with Daly (2015) that, while all philosophy is highly speculative – and necessarily so in order to make interesting, novel, and general claims – it is not the case that all speculation is idle. The point is not whether claims are speculative but whether those claims are adequately argued, so that a reasonable basis is presented for accepting or rejecting them. The aim here is to present arguments in the form of adequately reasoned speculations. But consequently, perhaps messily, the outcome may be vulnerable to reasonable differences of interpretation on epistemological grounds. Richardson (2007) likens scientific hypothesis testing to building a criminal case: incontrovertible evidence is rarely available, and, because there are no easy lines to be drawn between good and bad explanations, there is bound to be scope for different jurors to reach different conclusions. The inevitable ambiguity of scientific findings is not necessarily a sign of failure: recalling Kuhn's stance, the potential for personal differences in response may be a prerequisite for the emergence of any new theory, because it opens up the possibility for rational minds to look at the same evidence and to disagree on its meaning (Kuhn, 1977).

1.6.4 Evolutionary Psychology

The need for intuitive philosophising poses special dangers for this study not least on account of the third major field it aims to integrate – psychology and, calling as it does for an evolutionary analysis of a psychological phenomenon, evolutionary psychology in particular. To foray into this domain is to invite methodological contention. Buller (2005) claims indeed to see two varieties of evolutionary psychology: there is evolutionary psychology, a confluence where the fields of psychology and evolutionary biology meet; and there is what Buller capitalises as Evolutionary Psychology (EP), an informal but distinctive school of thought that seeks to apply to the analysis of human cognition and behaviour the same neo-Darwinian principles that biologists apply to human physiology and the rest of the natural world. Over recent decades, EP has developed certain theoretical tenets and preferred methods (Buss, 2005; Confer et al., 2010) which not everyone accepts and some vociferously dispute (e.g., Eldridge, 1995; Rose & Rose, 2010). There is not

space or need here for a full review of the arguments for and against EP as a scientific (or, according to some, pseudoscientific) field, much of which is not central to this inquiry: specific issues will be discussed in later sections as the need arises. But it is important to highlight what appears to be the main general objection to EP, which is an arguable shortfall in the epistemological reliability of the evidence weighed against the sociopolitical risk of reaching the wrong conclusions (Kaplan, 2002; Kitcher, 1985; Palmer, 2002).

The evidential problem for evolutionary psychologists is that two comparative methods used routinely by biologists to illuminate evolutionary processes may be closed off to human psychological research because of the absence of control groups or benchmarks to measure against (Faucher, 2012; Richardson, 2007). The first of these techniques seeks to compare the dynamics of populations that have different genetic constitutions; the chain of inference is that such characteristics may differentially affect reproductive fitness and thereby drive differential shifts at a population level. To illustrate with a classic human study of this type, the antimalarial effect of the sickle-cell gene can be deduced from observations that normal individuals suffer higher mortality and lower fertility in malarial environments than do sickle-cell individuals, resulting in proportionately more sickle-cell offspring surviving into successive generations (Wiesenfeld, 1967). Unfortunately, no equivalent psychological characteristic, suicidality included, has yet been found for which discrete genotypes can be followed through into cross-generational outcomes (Richardson, 2007). This is not to say that psychological traits have not spread through differential rates of survival and reproduction over the course of human history but that there may be insufficient genetic variation in the species now to evidence such a dynamic in action. Research in EP in this respect may be hobbled by the human race's genetic homogeneity (Lewontin, 1972) – the biological basis, say some of EP's leading thinkers, of the psychic unity of mankind (Tooby & Cosmides, 1990a). A second favoured method infers the adaptive effects of a given biological feature by analysing its variation across comparable, closely related, taxa – so, for example, it has been shown that testis size across species of primates is associated with mating patterns; larger testes being found in those species characterised by more intense intra-sexual competition among males (Harcourt, Purvis, & Liles, 1995). Unfortunately again, with regard to high-level psychological capacities, too wide a gap separates humans from our closest primate relations to allow useful comparisons and associations to be made: a species-specific behaviour, as suicide appears to be, puts humans in a class of our own (Kaplan, 2002; Murphy, 2005).

There is, broadly speaking, a third method available as a fallback, expounded notably by Williams (1966, 1992, 1996) and advocated by researchers in EP (Andrews, Gangestad, & Matthews, 2002; Tooby & Cosmides, 1992). The approach involves assessing evidence of special design, the premise being that an evolved adaptation may be inferred by its observed conformity to an *a priori* design specification (Williams, 1992). Anomalies between an observed biological structure and the *a priori* specification may usefully trigger a reassessment of the structure's functionality and biological constraints and hence invite a rethinking of

the specification. This approach, a forward and reverse engineering, "studying a complicated system to uncover how it does what it does" (Dennett, 2013, p. 109), is a staple, perhaps the staple, of biological method. But it brings with it several difficulties, the severest perhaps being that there are multiple degrees of freedom both in the formulation of an *a priori* specification and in the assessment of whether that specification matches what is actually found. For example, Williams (1966) argues that the human hand can be presumed to be adapted for manipulation on account of its evident match to an *a priori* engineering brief for a device designed for manipulation. But Lauder (1996) points out that many alternative designs for a manipulative device could be proposed that would permit other outcomes – an octopus-like arm, for example. And then, for any given *a priori* design, as Williams (1992) himself acknowledges, judgements about whether an observed feature conforms to it are largely left to intuition, because there are no agreed general criteria by which to measure the closeness of fit. Continuing the example of the hand, there are many ways of looking at the hand's construction and mechanics – bone structure, neurology, ranges of movement, and so on – any of which may or may not be deemed relevant to the task of judging the adaptiveness of the hand's design. As a solution, Andrews et al. (2002) suggest that the argument of special design is complete only when it is demonstrably superior to other plausible alternative accounts – in other words, an inference to the best explanation (Harman, 1965).

For the most part in biology, human physiology included, a recourse to intuition to infer evolutionary function from currently observable pattern does not necessarily prevent the reaching of uncontroversial conclusions: for example, based on our knowledge of its plumbing, we intuitively accept William Harvey's hypothesis that the heart functions as a device to pump blood, without our feeling a need to invoke a generic set of epistemological rules to justify that conclusion. When workers in EP seek to apply essentially the same approach to the evolutionary analysis of human behaviour, however, no such unanimity holds. Indeed, Dawkins (2005, p. 975) observes that the whole field of EP has been "subject to a level of implacable hostility, which seems far out of proportion to anything sober reason or even common politeness might sanction." The critics of EP themselves admit to a double standard, one that emerges not so much from the quality of the evidence *per se* but from the higher standard of evidence they feel ought to be demanded of hypotheses that carry potentially serious sociopolitical risks – at the extreme, the succour they may offer to the discredited ideologies of social Darwinism and eugenics (Richardson, 2007; Sahlins, 1976; Vining, 1986). In other words, a visceral objection to the tenets of EP may be rooted in the fear of a potentially disastrous naturalistic fallacy, that supposed facts of human nature may be misused to justify ethical positions (Hagen, 2005). Kitcher (1985) makes the point thus:

> If a single scientist, or even the whole community of scientists, comes to adopt an incorrect view of the origins of a distant galaxy, an inadequate model of foraging behavior in ants, or a crazy explanation of the extinction of the dinosaurs, then the mistake will not prove tragic. By contrast, if we are wrong about the bases of human social behavior, if we abandon the goal of a fair distribution of the benefits and burdens of society because we accept faulty hypotheses about ourselves and our evolutionary history, then the consequences of a scientific mistake may be grave indeed. (1985, p. 9)

The concern is not unfounded. By almost imperceptible increments, a direct line can be traced from progressive evolutionary theorising among the early twentieth-century scientists, via widespread eugenic programmes in the USA and northern Europe, through to state-sponsored euthanasia, and the atrocities of the Holocaust: Kerr and Shakespeare (2002) warn that much the same technocratic culture as the one that drove that catastrophic trajectory prevails today.

It challenges complacency to observe that, within the field of suicide research, the little evolutionary theorising that has been undertaken to date has already translated itself into some troubling proposals for social policy. DeCatanzaro (1981) questions the efficacy and value of suicide prevention movements such as the Samaritans, on the grounds that suicide "…may benefit the larger society because it extracts from the population individuals consuming resources but without productive and reproductive potential" (1981, p. 143). In similar vein, Gallup and Weedon (2013) propose evolution-based policies designed to deter suicide bombings: "… one possibility would be to establish well paid, highly trained execution squads who could be dispatched in response to a suicide bombing incident to search out and systematically kill all of the suicide bomber's immediate family members" (2013, p. 793). "Other less drastic, but correspondingly less effective options," they continue, "might include forced evacuations, as well as seizures of property and bank accounts from the terrorist's extended family." Clearly, if such emanations from the scientific press are meant to influence the public and its policy-makers, then the proposals need to be very well grounded. Frustratingly, it seems that just where robust, unambiguous evidence is most called for, it may be least available – in the domain under study, there may be no option but to intuit evolutionary processes from current patterns. Any policy considerations would do well to take account of the tentative nature of the outcomes of this research method.

This book draws upon several heuristics from the EP movement (Goldfinch, 2015), one of which offers a further cautionary methodological message – that the human mind evolved for the purpose of survival, not to comprehend its own operations: it may be ill-equipped for accurate self-discovery (McGinn, 1993; Wilson & Dunn, 2004). This study's use of armchair theorising is therefore exposed to a weakness inherent in folk psychology (Churchland, 1981), the purview of "what everyone knows" about their own and others' minds (Dennett, 2013). The problem is what Cosmides and Tooby (1994) call instinct blindness – we lack the mental equipment to comprehend what is going on in our own psyches. It is likely not only that the brain is not designed to understand itself but also that in many respects it is designed positively not to understand. To illustrate, we can presume that vision would be dangerously compromised if the brain could consciously track its own reprocessing of the upside-down images projected onto the retina, alongside the resulting perception of the world the right way up (Cosmides & Tooby, 1997). Wherever illusion and misbelief have adaptive value, our intuitions may be expected not to cooperate in their realistic appraisal. Research into a matter as emotionally and culturally charged as suicide may be especially prone to this kind of impairment. For the same reason, if previously unperceived instincts are involved in suicidality, then their exposure may feel intuitively misguided: if, as Dennett (1989) suggests,

any theory that achieves progress is bound initially to be counterintuitive, then success for this project may make for some emotionally awkward outcomes.

There may be no easy solution to these and other problems of applying intuitive reasoning to scientific inquiries generally and to the question of the evolution of suicide in particular. The best that can be done, argues Levin (2015) pragmatically, is to subject intuitive claims to reflective scrutiny and to cross-check against the available empirical record, safeguards this investigation will seek to adopt. It will seek to synthesise and make inferences on the basis of existing theoretical evidence and multiple secondary and tertiary sources. No new empirical data are offered, for two reasons: first, accumulated over more than a century, a large body of data already exists in the field of suicide, to the point that the greater opportunity lies not so much in adding to it but in attempting to develop fresh perspectives by which to understand it (Lester, 2000a, 2000b). Second, until a coherent theoretical framework can be established, there is no *a priori* basis on which to decide what kind of fresh empirical evidence may be useful: it is intended, however, that potential new avenues of research form part of the book's conclusions.

The preceding pages may read as a catalogue of apologia, of major methodological problems without clear-cut solutions. Clearly a project of this type is an ambitious one and possibly overambitious. Sober (2008) likens scientific inquiry to politics, it being an art of the possible, and to the man who searches for lost keys under a lamp post not because that is where he expects them to be but because that is where the light is. This book may be regarded as an exercise in seeing how far into the gloom it is possible usefully to search. Success is not guaranteed: Schaller (2002) compares generally accepted evidentiary standards in evolutionary psychology to heaven – perhaps impossible to reach, but worth striving for anyway on account of lesser rewards to be collected along the way. The prize for such incidental advances may be great – some clues, perhaps, to a long-standing mystery of the human condition and potentially some fresh ideas to address what policy-makers judge to be one of mankind's greatest public health challenges. Any conclusions are likely to be tentative, provisional, and open to disagreement, but nonetheless worth the endeavour.

1.7 Summary and Structure

The following chapter, Chapter 2, reviews the few available evolutionary hypotheses that may be put forward to explain the existence of suicide and reaches the view that the behaviour probably evolved as a non-adaptive side effect of one or more species-specific, species-universal, primary adaptations – these most likely connected with the uniquely sophisticated nature of human cognition. Chapter 3 focuses on two candidate cognitive adaptations that, when combined, would expectably produce suicide as a by-product: first, the capacity to experience emotional pain, which, like pain generally, may be biologically designed to force action to escape it; and second, the emergence in adolescence of a mature human intellect which is, incidentally and maladaptively, capable of conceiving of and enacting an escape from

pain by self-killing. The universality of these "pain and brain" qualities, acting as the motivation and means for suicide respectively, raises the novel question of why only a small minority of humans do actually take their own lives. Suicide is considered as an adaptive problem, for which solutions would expectably have emerged by selection. The inference is made that one or more psychological mechanisms – last lines of defences against suicide – would have evolved that detect the danger and forestall suicides in those at risk. Chapter 4 asks how these defences would be expected to work and formulates an *a priori* engineering specification. The specification includes *inter alia* a triggering input signal – the experience of intense and chronic emotional pain; a developmental threshold of puberty, the life stage at which suicide emerges as a threat; and outputs – diverse and potentially drastic countermeasures that function to attenuate the pain motivation for suicide, or the intellectual means, or both. Chapter 5, in search of actual phenomena that match the specification, is obliged to make the challenging and initially counterintuitive observation that certain symptoms of depression, addiction, and other common mental disorders would appear to show evidence of special design – that some psychopathologies, long known to correlate with suicidality, may mobilise to promote survival among those in most danger of taking their own lives. Chapters 6 and 7 look beyond reactive defences and argue for the likely existence of broader systems of pre-emptive anti-suicide mechanisms by which humans are enabled voluntarily to avoid, or failing that tolerate, pain – a biological signal that evolved not to be tolerated. Chapter 8 summarises and assesses the findings and notes some perhaps radical implications for suicide research and mental health policy.

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Chapter 2
Reviewing the Options: Noise, Adaptation, and By-Product

When you have excluded the impossible, whatever remains, however improbable, must be the truth. – Arthur Conan Doyle[1] (1859–1930)

The introductory chapter infers that the capacity for suicide – intentional self-killing – shows signs of having emerged among humans in our deep prehistory, it apparently being a species-universal, species-specific behaviour (Mishara, 2006). A conundrum arises because suicide would appear to be catastrophically deleterious for the reproductive fitness both of the individual who does it and for the individual's genetic relations; and the behaviour seems to offer the levers – heritability and variability – by which it could, over an evolutionary timescale, expectably be eliminated by natural selection. Instead, evolutionary processes have apparently held the trait in place.

How might this puzzle be resolved? Setting the parameters for possible solutions, neo-Darwinian evolutionary theory, around which a scientific consensus has established (Huxley, 1942/1963; Mayr, 1982), holds that there are but three known mechanisms by which any characteristic, whether physiological or behavioural, may be transmitted genetically across generations (Buss, Shackelford, Bleske, & Wakefield, 1998; Goetz & Shackelford, 2006; Hendry et al., 2011; Lieberman, Tooby, & Cosmides, 2003; Tooby & Cosmides, 1990a, 1990b, 1992, 2005; Williams, 1966; Wright, 1932, 1943). It could be (a) an adaptation, favoured by natural selection because of the relative fitness advantages it gives to the offspring of those who inherit the trait; or it could be (b) a by-product of an adaptation – the trait may not be advantageous in itself, but it may have spread because it is coupled with another trait which is advantageous. Alternatively, if a trait is neither advantageous nor disadvantageous, then under certain conditions it may (c) drift through a population by random genetic processes. Which account best fits suicide? Each possibility will be reviewed in turn, starting with the latter (c) only because the hypothesis that suicidality emerged and prevails as a genetic accident is probably the easiest to assess and

[1] *The Adventure of the Beryl Coronet* (1892).

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to set aside. Of the three options, the idea that suicide propagated as a maladaptive concomitant of an adaptation seems provisionally the most appealing, subject to a fleshing out of its theoretical substance, attempted in the subsequent chapters.

2.1 Suicide as a Result of Genetic Noise

Some biological traits can spread by chance. Stochastic mechanisms form an important part of modern evolutionary theory, led by Sewell Wright's elucidation of the ways in which genes may spread across, and fix in, small populations through accidents of sampling and inbreeding (Huxley, 1942/1963; Wright, 1932, 1943). Random effects are sometimes observable in small, isolated races of flora and fauna: the characteristics of remote island populations may, for example, have more to do with the genetic material that happened to be carried in with the founding colonisers, or with the random spread of mutations, rather than by an optimal matching of phenotypic traits with the fitness demands of the local environment.

Could such genetic "noise" account for the evolution of suicidality in humans? Almost certainly it could not, for at least three reasons. First, as discussed above, suicidality is not only a problem for small isolated populations of humans – it occurs the world over. Notwithstanding the rich variety of differences between individuals, humans seem to have a similar psychological makeup everywhere, suggesting that the human mind is everywhere subject to much the same selective pressures (Dobzhansky & Montagu, 1947; Tooby & Cosmides, 1990a). This geographic uniformity is not limited to psychological features: the human species appears generally to be characterised by a higher degree of genetic homogeneity than is found in other higher animals (Boyd & Silk, 2006; Lewontin, 1972; Marks, 2010; Steiper, 2010). Interbreeding characterises our species, migrations and intermarriages maintaining a continuous flow of genes between adjacent populations that swamps any non-trivial local genetic irregularities (Huxley, 1942/1963). Second, as was discussed at length in the Introduction (Sect. 1.3), suicide is predictably non-trivial in its fitness consequences. In any sizeable population, the genes that tend randomly to drift are those that are inconsequential for reproductive success. A gene that brought the slightest net fitness advantage would gradually spread through a population and fix itself there by selective pressure, and by the same process, a gene that brought a net fitness disadvantage would be expected to disappear.[2] Self-killing, it can be safely presumed, does not fulfil the criterion of a zero, or even near-zero, fitness effect. For that matter, it is hard to think of many heritable human attributes that

[2] To be more precise, a trait could also originate as fitness-neutral and fix by random drift before subsequently becoming advantageous (Lukeš, Archibald, Keeling, Doolittle, & Gray, 2011). Recent theories of constructive neutral evolution also suggest that slightly deleterious mutations too may find a way to fixation (Stoltzfus, 1999, 2012). Neither nicety would add much support to a "noise" hypothesis of suicide as it remains hard to conceive of suicide as neutral, advantageous, or even only slightly disadvantageous in its fitness impact.

would do – the arrangement of coloured flecks in the iris, or the way intestines are packed in the gut, perhaps (Tooby & Cosmides, 2005) – as Thornhill and Palmer (2001) note, insignificant characteristics that fix in populations by chance tend not to attract much scientific interest. Third, in a sizeable population, non-trivial traits that occur randomly tend to be transitory (Hendry et al., 2011); but there is no evidence at least in the historical record that suicidality is anything other than a permanent feature of our species (Colt, 1991; Fedden, 1938).

This is not to say that random genetic processes do not play a role in suicidality; rather, it is hard to see how such processes can explain directly the evolution of the behaviour. The genetic component of suicide risk can be envisaged as a thin dispersal across the human genome: no suicide gene has been found, or perhaps ever will be, as it seems that any genetically heritable risk arises from a combination of many genetic variations, each of small effect, interacting between themselves and with complex environmental and epigenetic factors (Baldessarini & Hennen, 2004; Blekhman et al., 2008; Bondy, Buettner, & Zill, 2006; Calati et al., 2014; Mullins et al., 2014; Turecki & Brent, 2016; Zai et al., 2015). The genetic origins of variability in suicide risk, along with variations in psychopathologies and countless other dimensions of behaviour, may be understood as being blended across the human population in what Tooby and Cosmides (1990a) describe as a sea of genetic diversity, brought about by random mutations and sexual recombination. These complex genetic variations may influence individual propensities to suicide – the distribution of suicide risk around a mean – but they shed little light on the origin and existence of the mean, why a certain base level of suicide occurs at all (Andrés & Halicioglu, 2011; Lester & Yang, 2005; Yang & Lester, 1991, 2009). The field of behavioural genetics generally may have much to say about the variability of psychological traits within specific populations, but it is mute about the traits' commonalities across a species: it offers few, if any, insights into the means and qualitative absolutes around which traits quantitatively vary (Neale & Cardon, 1992).[3] Its methods might help to explain why, say, a particular individual is shorter or taller than average, but it will not reveal why human beings tend to be 1.65 m as opposed to 0.65 or 3.65 m tall.

A proposal by Keller and Miller (2006), posited to explain why some common mental disorders tend to run in families, illustrates some of the limitations of genetics in this regard: their theory is arguably relevant here because mental disorders and suicidality are epidemiological correlates, so an explanation for mental disorder might by extension be hypothesised to help account for the heritable component of suicide risk (Voracek, 2006a). The central idea is of *mutation-selection balance*, arising from the random copying errors and other mutations in an organism's genetic

[3] As an aside, behavioural genetics might help to explain the evolution of the breadth of variability in suicide risk: in general, and perhaps counterintuitively, it seems that the more a trait impacts on an organism's overall reproductive fitness, the greater that trait's genetic variability (Hughes & Burleson, 2000; Keller, 2008; Rodgers et al., 2001). To use Keller and Miller's (2006) metaphor of a catchment basin, suicide risk (at the downstream, estuary end) might be highly variable on account of having a large upstream network of contributory variables feeding into it – a large array of personality and cognitive traits, for example.

code that can build up over generations and produce heritable variations in reproductive fitness. Over time, these usually deleterious mutations are eliminated by natural selection, only to be replaced to some degree by new random mutations that arise in the meantime. At a certain point of mutation-selection balance, old mutations are driven out of the gene pool as fast as new mutations take their place, producing a steady level of dysfunctional phenotypic outcomes. According to Keller and Miller, the human brain may be particularly susceptible to mutations because of the concentration of genetic material involved – something like half of the human genome is devoted to the brain's construction (Keller, 2008; Keller & Miller, 2006): the resulting heritable errors in the brain's genetic makeup can manifest themselves, they say, as heritable susceptibilities to common mental disorders.

While this model may usefully explain variations in susceptibilities, it leaves unexplained why diverse, random mutations should produce common psychiatric syndromes with their patterned specificity (Gangestad & Yeo, 2006; Polimeni, 2006) and their enduring geographic, cultural, and temporal peculiarities (Uher, 2009). Likewise with suicide, a general problem with citing the buildup of mutations, or, indeed, other random processes, to explain suicide is that it is no random outcome. It is a behaviour characterised by certain particular features (Shneidman, 1992), at the most basic level entailing a self-initiated, intentional death. The unanswered question is why a random genetic process would lead to this particular outcome as opposed to any other. It may be that a certain genetic mutational load can lead to a threshold of instability being crossed in an individual (Gottesman & Shields, 1967): at a critical point, incremental random mutations might catastrophically trigger a cascade response (Gangestad & Yeo, 2006). However, for such a process to produce a suicide outcome implies the existence of an additional non-random canalisation mechanism, as yet unidentified, that eventuates in that particular end product. Canalisation is normally, and reasonably, discussed in the context of protectiveness: channelling, stabilising defences may function to buffer vital biological systems from genetic mutations and other random stressors (Thornhill & Møller, 1997; Yeo, Gangestad, & Thoma, 2007). Problems can arise when these defensive stabilisers fail (Gibson, 2009; Gibson & Wagner, 2000), especially, some believe, with regard to mental functioning (Yeo, Gangestad, Edgar, & Thoma, 1999; Yeo et al., 2007).[4] Turning the idea upside down, conceptually it is possible to imagine some kind of a malignant stabiliser – a special process, unique to humans, which systematically channels random stressors into a suicidal act. Such a canalisation dynamic may indeed be presumed to operate – but then, the entity that calls for an evolutionary explanation for our purposes is the non-random channelling towards a suicidal output,

[4] As an incidental point, traits under positive selection are believed to be subject to more genetic variability than those under negative selection on the grounds that positively selected traits would have a lesser need for stabilising buffers (Richard & Yvert, 2014). On this basis, the genetic variability of suicide risk may point, perhaps counterintuitively, to suicidality actively being promoted by natural selection.

rather than the random inputs. We are left still having to account for the evolution of whatever it is that drives people to take their own lives as opposed to some other behaviour.

To conclude, suicide appears to have too strong a fitness effect and is too stable and too specific an outcome for its emergence and maintenance in large human populations to be plausibly ascribed to random genetic processes, or at least to such processes alone.

2.2 Suicide as an Adaptation

Moving on to the second possibility, suicide might be an adaptation – "phenotypic features (morphological structures, physiological mechanisms, and behaviours) that are present in individual organisms because they were favoured by natural selection in the past" (Thornhill & Palmer, 2001, p. 5). It is good to have considered, and effectively discounted, the "noise" hypothesis first: in the interests of parsimony, Williams (1966) counsels that biological features should not be called adaptations if less onerous alternatives such as chance offer simpler explanations. Evolutionary psychology (EP) is sometimes accused of neglecting this advice and jumping too readily to adaptive conclusions (Buller, 2005; Gould, 1982; Rose & Rose, 2010). EP's proponents, on the other hand, argue that, since natural selection is the only known biological process that brings order to populations of organisms, against the forces of entropy, adaptation can justifiably be used as a default explanation for a psychological pattern until a better explanation is found (Tooby, Cosmides, & Barrett, 2003). A body of opinion in general biology would share that adaptationist view: Hendry et al. (2011) for example, advise that it is safe to start with an adaptive hypothesis simply because it is often true.

So, as a provisional hypothesis, could suicide be adaptive? Could suicidality have been positively favoured by natural selection during the evolution of mankind because of some net fitness advantage to be gained from intentional, deliberate self-killing? "Probably not," would be the commonsense answer for many people, clinicians and researchers included – Shneidman (1985) recounts Stephen Pepper's seeming statement of the obvious from more than half a century ago:

> It is most unlikely that the drive to commit suicide, whether piecemeal or all at once, is an instinctive basic drive. For organisms so endowed would long ago have eliminated themselves and left the world to those inheriting repertoires of drives towards self-preservation. (Pepper, 1942, p. 242)

If, on the other hand, suicide is an evolved adaptation, then it would have to confer a fitness payoff so strong that it more than outweighs the extreme fitness handicap of being dead, as described in Chap. 1 (Sect. 1.3): what could such an overriding benefit be?

2.2.1 *Reproductive Potential*

If it takes a leap of imagination to see how killing oneself could improve one's reproductive fitness, deCatanzaro (1980) offers a lower hurdle by suggesting there may be circumstances in which an individual's reproductive prospects, while not improved by suicide, may already be so minimal that killing oneself would not make things any worse. Evolution might tolerate suicidality among people who have no prospect of further procreation for lack of any mechanism to select against it. Dawkins (1980) connects the idea with the theory of senescence – that an organism's genes have more invested in the organism's well-being earlier than later in life, because youth presents a longer reproductive career through which its genes may propagate (Medawar, 1957; Williams & Williams, 1957). As genes often have multiple influences on an organism's structure and behaviour (pleiotropy), the same gene may express itself at different stages, and often in different ways, during the course of an organism's development. If a gene improves fitness at the peak of an organism's reproductive potential, but brings about disadvantages later, then such a gene could be favoured by selection because of its overall reproductive advantage across the life span. This dynamic would explain why Pacific salmon, fish that breed only once, disintegrate in their upstream spawning waters once their mission to reproduce is done – with no prospect of further reproduction, there is no means by which any then emergent lethal traits could be selected against. DeCatanzaro (1981) posits that, as any organism may be heading for a salmon-like decay if it has predictably zero reproductive potential, humans facing a childless future would be prone to suicide for want of any genetic reason for staying alive. They are already, in deCatanzaro's (1981) phrase, genetically dead. On this basis, deCatanzaro argues that suicide could be an explicable behaviour for people who are elderly, terminally ill, socially isolated, and/or (hetero)sexually unsuccessful. Cognitive states, such as feelings of hopelessness, entrapment, or a sensed inability to cope with life may, he suggests, act as internal emotional signals, informing the organism of its loss of reproductive purpose and hence opening the door to suicide. Men would be more likely to enact suicide than women, on the grounds that fathers generally play less active roles in the upbringing of their children than mothers do (deCatanzaro, 1980, 1981, 1991).

DeCatanzaro's picture of suicidogenic senescence may appear consistent with some of the epidemiological record. Suicide rates in developed countries, and averaged globally, are indeed highest among the elderly (Girard, 1993; Värnik & Wasserman, 2016), an observation which prompts Voracek (2006a) to compare suicide to a late-onset disorder. Suicide risk is also linked with some posited proxy measures of low reproductive potential, such as long-term sickness, social isolation, and sexual failure (Brown et al., 2009). In many countries, men are more likely to take their own lives than are women (Möller-Leimkühler, 2003), and feelings of hopelessness and entrapment are also known to be associated with suicidality (Beck, Kovacs, & Weissman, 1975; Williams & Pollock, 2000), associations which deCatanzaro (1981) suggests are consistent with his proposals. Later theorists have

proposed other evolutionist ideas that align with deCatanzaro's. Campbell (2002) concurs that women should be less prone than men to taking their own lives due to their greater opportunities for investing in their offspring; and Saad (2007) attributes suicidality to reproductive "crushing defeats" – adverse life events that constitute a pernicious attack on reproductive fitness.

Self-evidently it is true that, at least among humans, evolution can tolerate suicide – hence this debate. But there is cause for scepticism that the notion of reproductive potential offers explanatory value, for at least four reasons.

First, while selected epidemiological statistics may appear to support the idea of reproductive potential as a correlate of suicidality, the entirety of it does not (Lester, 2014b). Suicide cannot be easily characterised simply as, or at all as, a late-onset disorder. The global rate of suicide per thousand people does tend to increase with age, but then, so does the death rate generally. When expressed instead as a raw number of deaths, or as fraction of total deaths, suicide can be seen to be a problem predominantly of adolescence and young adulthood: more under-45s die from suicide than 45s and older (Värnik, 2012). Suicide rates among males and females, at different levels, appear to follow similar patterns across the life span, but the sociodemographic group most at risk of suicide ideation and attempts is not old men but young women – their protection, such as it is, arises mainly from their tendency to use less lethal methods (Nock et al., 2012).

It is hard to see how this mass of suicidality among young adults, people who would be presumed to be at the peak of their reproductive careers, fits a model that presumes minimal reproductive potential. To illustrate how little explanatory value the model offers, Rubinstein (1986) points to the marked shift in the demographics of suicides in Taiwan before and after the 1940s (young women were the highest-risk group before, older women thereafter) and to the vulnerability of youth across parts of Micronesia. The implication is that shifting patterns of suicide risk are primarily being shaped by cultural dynamics, rather than demographics *per se*. Similarly contrary are studies that suggest suicide may be a particular risk among those with high or rising incomes (Agerbo et al., 2001; Goldsmith, Pellmar, Kleinman, & Bunney, 2002; Hamermesh & Soss, 1974) and with good educations (Delisle, 1986; Voracek, 2004, 2006b) and among the intellectually gifted (Shneidman, 1993, 1996) – populations who would not easily be classed as socioeconomically, and presumably reproductively, hopeless. As solutions to the anomaly of suicides among the gifted, deCatanzaro (1981) offers (a) that very clever people may be less well adapted to succeed in normal social conditions and (b) that a certain minimum intellect may be required to perceive a situation to be hopeless and to realise the genetic pointlessness of life in such circumstances. Perhaps more straightforwardly, as Voracek (2004) counters, suicide may sometimes reflect not so much people's potential or lack of potential but rather their worries about fulfilling their potential.

Second, the premise of zero reproductive potential seems to be at odds with the way humans, and mammals generally, are strategically geared to procreate (Lankford, 2015). Unlike Pacific salmon (semelparous – they breed only once), humans and virtually all other mammals are iteroparous – designed for multiple

reproductive episodes (Cole, 1954). Human males usually remain potentially reproductive throughout their adult lives (Bribiescas, 2006). Aside from menopausal women – a group which, signally contraindicating the reproductive potential hypothesis, is not particularly linked with suicidality (Shah, 2007; Usall et al., 2009) – there is no life stage when humans can absolutely rule out the possibility of future opportunities for reproduction. It may be at least partly for this reason that suicide has not been found to occur among other higher animals: however bleak an animal's situation, there always remains some residual fitness value in survival. Animals appear to know when they are trapped (Malkesman et al., 2009; Overmier & Seligman, 1967) – they respond by the loss of motivation to act, and they sometimes self-injure (Jones, 1982) – but even certain entrapment does not lead them deliberately to kill themselves (Goldney, 2000). Lankford (2015) reiterates a point made by Dawkins (1976) that animals are observed to be similarly accepting of non-reproductive status: in situations where a low-status male is denied opportunities to mate, its best bet is not self-destruction but self-preservation – biding its time on the chance, however slim, of a change for the better. Evolutionary logic would likewise suggest that the best fitness strategy for any human, aged bachelors included, is to soldier on (Bribiescas, 2006; Dawkins, 1980; Wright, 1994).

Third, even for those who may have zero prospects of direct reproduction, survival may still carry above-zero value in terms of inclusive fitness (Bribiescas, 2006) – inclusive fitness arising from the possibility of enhancing the reproductive success of others who share the individual's genes (Hamilton, 1964). Direct reproduction is not the only way an organism can achieve genetic success: behaviour that promotes the reproductive fitness of close relations can vicariously have the same result (Dugatkin, 2007). Wright (1994) points out that "almost anyone – except the seriously handicapped, or the extremely old and infirm – could, by staying alive, contribute substantially to their reproductively valuable relatives: gather berries, tend children, teach children..." Many suicides are isolated from their families, but even these may not be able to rule out having some kin somewhere who might one day gain from the person's availability to invest in their reproductive futures, and who might, for the sake of inclusive fitness, be worth staying alive for. Even, or perhaps especially, menopausal women may have reproductive prospects in this regard – one widely supported evolutionary explanation for human menopause is that a grandmother, with a lifetime's wisdom to impart, may obtain a greater fitness return at lower risk by assisting younger kin with their parenting than from the parturition and raising of more children of her own (Hawkes, O'Connell, Jones, Alvarez, & Charnov, 1998).

Finally, while senescence might explain a weakening of selective pressures in general, it does not in itself account for suicide specifically. Any number of other non-adaptive behaviours might equally emerge in an organism that has supposedly aged beyond the reach of natural selection: the question arises, again, why self-murder should come about rather than some other outcome. In this respect, the question of suicide's specificity presents much the same difficulty for reproductive potential as an explanation as does the citing of random genetic causes discussed earlier (Sect. 2.1 above): some additional canalisation process is required to account for the conversion of a disordered input into a patterned end product.

2.2.2 *Altruism: Relieving Kin of the Burden of One's Existence*

If low reproductive potential undermines an animal's genetic reasons for living, deCatanzaro (1980) proposes altruism as a source of positive, fitness-promoting reasons to die. To expand briefly on the principle of inclusive fitness raised earlier, individuals have shared genetic interests proportionate to their degree of relatedness (Hamilton, 1964). The theory is said to originate from a quip made by the geneticist J B S Haldane: when asked if he would lay down his life to save his brother, the answer was no, but he would for two brothers – or eight cousins (Maynard Smith, 1975). A corollary is kin selection, the term coined by Maynard Smith (1964) to describe the strategy of favouring the reproductive success of an individual's kin relations, even at the expense of the individual's own survival and reproduction. Such apparently altruistic, but genetically self-serving, behaviour is commonly found among social insects – hymenopterans such as bees, wasps, and ants – because of the special familial composition of their colonies. Where only one female is permitted to breed and all the other colony members are non-reproducing siblings, sterile individuals have a genetic interest in sacrificing themselves if necessary for their queen and colony's defence (Bourke, 2008; Shorter & Rueppell, 2012).

Such self-sacrificing nonhuman behaviours have inspired a number of theorists, led by deCatanzaro (1981, 1986, 1991, 1992), to propose analogous explanations for human suicide (Blasco-Fontecilla, Lopez-Castroman, Gomez-Carrillo, & Baca-Garcia, 2009; Brown, Dahlen, Mills, Rick, & Biblarz, 1999; Joiner, Buchman-Schmitt, Chu, & Hom, 2017; Joiner, Hom, Hagan, & Silva, 2016). Suicide might be an act of altruism where an individual sacrifices his own life, kamikaze-style, in his kinship group's defence (Gallup & Weedon, 2013; Orbell & Morikawa, 2011); or to punish one of the group's wrongdoers (Tousignant, 1998); or when he becomes such a burden that his relatives would be better off without him (Aubin, Berlin, & Kornreich, 2013). This burdensomeness may arise where an individual becomes infectious (Tanaka & Kinney, 2011) or, whether real or merely in the suicidal individual's perception, a drain on relatives' resources (Joiner, 2005). This latter form of burdensomeness is the main focus of deCatanzaro's theoretical work (e.g., 1986) and, out of the varieties of altruism theories, has received most attention in suicidology (Aubin et al., 2013; Brown et al., 1999, 2009; Joiner et al., 2016; Van Orden et al., 2010). Putting the reproductive potential hypothesis together with the notion of burdensomeness, deCatanzaro (1986) postulates an additive suicidogenic effect; suicide may be evolutionarily explicable where burdensomeness co-occurs with the absence of prospects for future reproduction.

The idea that suicide may be driven by a sense of perceived burdensomeness is consistent with a spread of empirical findings: measures of self-reported burdensomeness have been found to correlate with suicidal ideation and behaviour in diverse experimental settings (e.g., Brown et al., 1999, 2009; Cukrowicz, Cheavens, Van Orden, Ragain, & Cook, 2011; deCatanzaro, 1986, 1995; Jahn, Cukrowicz, Linton, & Prabhu, 2011; Van Orden, Lynam, Hollar, & Joiner, 2006; Van Orden et al., 2010; Wenzel & Spokas, 2014). Joiner et al. (2002) link self-perceptions of

burdensomeness inferred from suicide notes with the lethality of attempts – an association albeit not replicated by other studies of suicide notes (Gunn, Lester, Haines, & Williams, 2012; Lester & Gunn, 2012; Pettit et al., 2002). Bereaved relations often disclose that they had indeed felt troubled by the deceased before the suicide (Magne-Ingvar & Öjehagen, 1999). Some tribal societies are reported to condone certain forms of assisted suicide that might be consistent with the idea of altruistic self-removal: in certain situations, elders too physically infirm to survive the next journey or the next winter may be helped by nearest kin to a voluntary death, within strict codes of tradition, although this is far from saying that such practices are normal across traditional societies (Falger & Falger, 2003).

DeCatanzaro's (1981) ideas also chime with at least two prominent theoretical frameworks. The first is a branch of suicide theory formulated outside of an evolutionary paradigm: Joiner's (2005) Interpersonal-Psychological Theory of Suicide (IPTS) and its later variants (Joiner et al., 2016; Van Orden et al., 2010), hold perceived burdensomeness to be a risk factor that, when combined with an unmet yearning for meaningful relationships with others and a learned capability to carry out the act, can lead people to take their own lives. IPTS, it may be recalled, is one of the family of suicide models characterised by Klonsky and May (2015) as sharing an ideation-to-action framework, discussed in Sect. 1.4 above. The framework has proved attractive as a basis for research (e.g., Fink-Miller, 2015; Kleiman, Law, & Anestis, 2014; Kleiman, Liu, & Riskind, 2014; O'Connor & Nock, 2014; Silva, Ribeiro, & Joiner, 2015; Van Orden & Stanley, 2013; Van Orden et al., 2010): the weight of empirical evidence arising from such tests of IPTS, that burdensomeness does indeed associate with suicidality (Gunn & Lester, 2014; Paniagua, 2010; Ribeiro & Joiner, 2011), might be taken as indirect support for deCatanzaro's model (Aubin et al., 2013).

A second possible theoretical fit, and in this case within evolutionary biology, is with the idea of group selection (Maynard Smith, 1964; Wilson, 1975; Wilson & Wilson, 2007). Although debate continues in some quarters (e.g., Pinker, 2012; Sterelny, 2007), a body of mainstream evolutionist thinking accepts that natural selection can occur at multiple levels and that a Darwinian struggle for existence can play out between, for example, competing groups as well as between competing individuals (Wilson & Wilson, 2007). Sober and Wilson (1998) argue that much of human behaviour may have evolved for the group's benefit, and that groups may not need to be entirely kin-based for natural selection to operate. It may be that altruistically suicidal behaviours could have emerged through the reinforcing effect of cultural systems of rewards and punishments, to some degree independent of genetic interrelatedness (Orbell & Morikawa, 2011).

So, some empirical and theoretical support can be found for a hypothesis that altruism in general, and burdensomeness in particular, could make suicide a genetically adaptive behaviour. But the idea has made little headway in suicidology (Brown et al., 1999, 2009; Voracek, 2004), and it faces criticism (e.g., Joiner, 2005; Lester, 2014b). There are at least four areas of misgivings relevant to this discussion: manifold conflicts with the empirical record; the absence of a causal link between burdensomeness and self-murder; an asymmetry of fitness risks and pay-

offs that point to homicide, not suicide, as the more logical genetic resolution to burdensomeness; and the difficulty of arguing for the evolution of a general-purpose fitness-maximising mechanism that would detect and respond to one's becoming a fitness liability, a device which is presupposed by deCatanzaro's hypothesis.

First, to posit burdensomeness as an evolutionary driver for suicide appears counter-factual on several grounds. First, as already noted, epidemiological data show that most suicides in the world, and suicides as the highest share of deaths, occur among younger adults – people who are unlikely to constitute the most onerous handicaps for their societies. Indeed, the epidemiology of suicide runs in the opposite direction to what might be expected from a logic of productiveness: the risk of the first onset of suicidal behaviour rises sharply during adolescence and peaks in early adulthood (Nock et al., 2012), stages of life when the average human's net economic productivity is rapidly increasing, reversing, and economically compensating for the years of childhood dependency (Kaplan & Lancaster, 2003; Lancaster & Kaplan, 2007). Advocates of deCatanzaro's model might caution that it may not fit the current epidemiology of suicide because today's technological and societal environment may not match the conditions that humans evolved to deal with and to which the model refers (Brown et al., 1999). Such a mismatch may be a contributory factor to suicidality (Aubin et al., 2013), although we will probably never be sure of its significance because our environment of evolutionary adaptedness (EEA – Bowlby, 1969/1997), a statistical composite of relevant prehistoric conditions, cannot be directly observed (Tooby & Cosmides, 1992). What can be observed, however, are high rates of youth suicide across a diversity of cultures (e.g., De Leo et al., 2013; Jollant & Macdonald, 2015; Jollant, Malafosse, Docto, & Macdonald, 2014; Rubinstein, 1983, 1986), including pre-industrial, pre-literate, and primitive societies (Brown, 1986; Hezel, Rubinstein, & White, 1985; Hoskin, Friedman, & Cawte, 1969; Reser, 1990; Zilboorg, 1936) suggesting, rather, that self-murder among the young is no mere novelty of modern civilisation. Second, as already noted, suicide is also a particular risk among high earners, who could be presumed to be among the more generative members of their communities (Goldsmith et al., 2002). Third, notwithstanding statistical correlations between perceived burdensomeness and suicidality, there is no evidence of a deterministic link: it is likely that most people who feel they are a burden do not entertain suicidal thoughts, let alone attempt to take their own lives (Van Orden et al., 2006).[5] Fourth, while it is true that the elderly and infirm are proportionately more at risk of suicide in many societies, this pattern can be satisfactorily explained by more parsimonious accounts: primarily, fewer old people survive suicide attempts, partly because of medical frailty and, often living alone, because they are less likely to be discovered (Goldsmith et al., 2002). Fifth, the causal arrow between burdensomeness and suicidality may point both ways: a feeling that your relatives might be better off

[5] Illustratively, Van Orden et al. (2006) report correlations between perceived burdensomeness and suicide attempt status to be $r = 0.21$ ($P < 0.05$) and between perceived burdensomeness and BSSI (Beck Scale for Suicidal Ideation) suicidality scores to be $r = 0.32$ ($P < 0.05$): $n = 343$ outpatients. While significant and interesting, such associations suggest that burdensomeness is far from a deterministic explanans for suicidality.

without you may sometimes be not so much a driver of suicide but rather a product of a chronically suicidal state of mind (McPherson, Wilson, & Murray, 2007). Sixth, most suicides are motivated by other concerns, according to their suicide notes (Chávez-Hernández, Leenaars, Chávez-de Sánchez, & Leenaars, 2009; Gunn et al., 2012; Meyer, Irani, Hermes, & Yung, 2017; O'Connor, Sheehy, & O'Connor, 1999)[6] and the self-reports of surviving attempters (Bancroft et al., 1979; Hawton, Cole, O'Grady, & Osborn, 1982; Jobes & Mann, 1999; Valach, Young, & Michel, 2011; van Heeringen, 2001; von Andics, 1947): the main reason people usually give for wanting to die is not to help or hurt others but to achieve an escape — primarily to gain relief from unbearable psychological pain or an intolerable situation (Shneidman, 1996). Contradicting the idea that suicides expect their deaths to benefit kin, suicide notes modally contain apologies for the self-killing, expressions of sorrow, and appeals for forgiveness (Foster, 2003; Meyer et al., 2017; Rao, Namaratha, Rao, & Raman, 2015; Sanger & Veach, 2008). Seventh, Chanley (1982) reasonably questions how much of a liability most suicidal people can be in practice since they are often detached from kin relations: social isolation, the absence of close friends and family, has long been known as a risk factor for suicide (Maris, 1991; Trout, 1980; von Andics, 1947). Finally, in any event, the grim sequelae experienced by families following suicides (see Sect. 1.3 above) suggest that, whatever fitness cost a person imposes on his kin by living, a greater cost may be expected to befall them by his self-murder (Mugisha, Hjelmeland, Kinyanda, & Knizek, 2011; Pitman, Osborn, King, & Erlangsen, 2014; Wertheimer, 2014).

The second difficulty is that deCatanzaro's (1986) model lacks a theoretical account of the supposed causal link between burdensomeness and suicide: supporting empirical correlations do not in themselves explicate causality. This logical gap reiterates the need to explain suicide's specificity: even if kin would gain fitness from an individual's removal, it is unclear why removal should translate into self-murder as opposed to some other outcome (Atkinson, 1978). Filling the gap left by the unanswered specificity question, there are good reasons to believe that other solutions to the problem of burdensomeness would make more genetic sense than would suicide. To reprise the point, except perhaps for menopausal women (who, tellingly, are not at a particularly high risk of suicide), and unlike hymenopteran insects and other eusocial species, humans are not characterised by extreme reproductive specialisation. Following the iteroparous reproductive strategy shared with virtually all other mammals, humans almost always have some direct or indirect reproductive potential to protect. As Lankford (2015) points out, the "ability to 'breed like rabbits' would be completely wasted by the rabbit who gives up its life to save four offspring, but loses out on producing eighty more." Hence other means of self-removal, if indeed self-removal is called for in the interests of inclusive fitness, would be expected to take precedence ahead of suicide. Voluntary exile, for example, would fulfil the requirement to unburden existing kin without at the same time ruling out the possibility of further reproduction: as Wright (1994, p. 389) points out, it would be more advantageous for "…say, a depressed man's genes if he

[6] Although, Joiner et al. (2002) found contrary results.

just wandered away from the village, hoping to find better luck elsewhere…" An even better solution might be for the burdensome individual to attempt to defect to a rival group, onto which, if he were accepted, the encumbrance of his continued existence could potentially be transferred and potentially to the competitive advantage of his own genetic kin.

Third, and expanding on the previous point, genetic logic and empirical observation suggest that death by another's hand, rather by than one's own, is the most likely resolution to problems of burdensomeness. In considering this point, it is useful to weigh the asymmetry of the risks and supposed returns involved in a fitness calculation to suicide.[7] For the suicidal individual, the genetic downsides of death are both severe and guaranteed: no more offspring and no more contributions to help existing offspring. While the downsides are certain, the fitness upsides from suicide, if any, are highly contingent. The putative beneficiaries – those supposedly to be unburdened – may not anyway survive; or if they do survive, they may not anyway reproduce; or they might have successfully survived and reproduced anyhow, regardless of the suicide (Lankford, 2013, 2014). Further, a sense of burdensomeness, the instinctual cue that deCatanzaro (1986) suggests could signal to the organism that a fitness gain is to be had from self-killing, may be prone to multiple sources of error. First, there are circularities: burdensomeness may be caused by suicidality, as well as the other way round – it can indeed be draining to care for someone who has chronic, self-destructive urges (Magne-Ingvar & Öjehagen, 1999). Second, as Rubinstein (1986) points out, it is likely that feelings of being a burden are ephemeral in their intensity: there is transience in emotional states generally (Bonanno, 2004; Proudfit, Dunning, Foti, & Weinberg, 2014), and suicidal states are apparently no exception (Hawton, 2007; Miller, 2013). It is telling that very few people who survive a suicide attempt go on to try again (Berman, Jobes, & Silverman, 2006; Joiner, 2010; Levi-Belz, Krispin, Galilee, Bodner, & Apter, 2017), although an objective measure of an attempter's economic utility would presumably be much the same after the attempt as it was before. Third, the objectivity of a person's assessment of their own value to kin can be questioned, as deCatanzaro (1986) himself acknowledges. A sense of burdensomeness, then, if that is the organismic cue that motivates supposedly fitness-enhancing self-killing, would seem to be an unreliable one: in view of the high fitness stakes involved, it would be an unlikely evolved basis for a decision as momentous as instigating one's own death. Given that suicides usually make life harder, not easier, for those left behind (Pitman et al., 2014), it seems that whatever fitness-enhancing computational mechanism is supposed to be involved in the decision to suicide can rather be relied upon to miscalculate.

The question arises, given the manifold risks and uncertainties, which party is best placed to decide if a liability is so onerous that it warrants the termination of a life to remove – the burdener or the burdened? Perhaps only the burdener can assess an aggregate liability – the sum of small handicaps imposed by his continued

[7] "Suicide" is sometimes used as a verb in this book, in part to avoid using the value-laden word "commit," for reasons discussed in Chap. 8.

existence on multiple kin. But the party that genetically has most to gain, and the better information on whether a load can be shouldered, would be the bearer of the load rather than its originator. As Skinner (1969) observes, a contingency in which an individual's death advantages others of the same species should favour the selection of behaviours in which those others do the killing. Wright (1994) argues that starvation is the about the only scenario where suicide might have Darwinian logic, but O'Connor (1978) finds that, based on his modelling and observation of nestlings' responses to starvation conditions, fratricide occurs ahead of suicide even then: no nestling has been seen voluntarily to swap the certainty of its own death for the uncertainty of its siblings' survival. Likewise, a human infant, however sickly or unsupportable, will not spontaneously die to relieve the burden of its existence from its kin – rather, it will use every behaviour in its repertoire to avoid rejection (Bowlby, 1969/1997, 1973; Hrdy & Sieff, 2015). Children up to about age 12 or 13, however dependent they are, almost never kill themselves – and those that do are characterised not by burdensomeness but, on the contrary, by their precocious resourcefulness (Shaffer, 1974). Homicide, on the other hand – by infanticide or abandonment – is observed in several species, many human cultures included, in circumstances where the carrying of unviable or unsupportable offspring significantly endangers a mother's future reproductive capacity (Dickeman, 1975; Harris, 1974; Hausfater & Hrdy, 1984; Hrdy, 1979; Minturn & Stashak, 1982).

Finally, reiterating a theoretical difficulty raised earlier in the context of a bargaining hypothesis of suicide's evolution (Sect. 1.3.3 above), and as Perry points out, to explain suicide as a means of maximising inclusive fitness presupposes that the individual is equipped with "a kind of 'inclusive fitness monitor,' noticing factors such as future fertility, ability to contribute, and burdensomeness on close kin" (Perry, 2015, p. 151). This hypothetical psychological device would, presumably, also need to anticipate the carrying capacity of the prospective environment (because the concept of burdensomeness has salience only in relation to a scarcity of resources) and the alternative breeding opportunities facing the kin group (because burdensomeness implies an opportunity cost, in terms of potential offspring forgone), in order to compute whether, taking everything into account, the individual's overall genetic interest would be best served by his self-removal. But modern evolutionary theory offers no obvious means by which this kind of all-seeing, all-embracing "fitness monitor" or fitness-maximising algorithm could evolve. Natural selection operates, rather, by responding to specific informational cues in the ancestral environment that correlated over evolutionary time with particular fitness payoffs. A system that lacks these specific input-output associations would have provided no adaptive advantage and is therefore unlikely to have been favoured (Symons, 1992; Tooby & Cosmides, 1990b). The lack of a global fitness-maximising system explains why humans often behave in ways that run counter to their genetic interests, such as by the adoption of children, contraception, or the taking of unnecessary risks by, for example, extreme sports, smoking, or unsafe sex.

Looking more widely at putative altruistic motives for suicide beyond the dimension of burdensomeness, the term *altruistic suicide* is more usually associated with Durkheim's (1897/1952) idea of self-sacrificial acts of battlefield heroism, a rare

behaviour both in his own view and others' (Leenaars & Wenckstern, 2004; Townsend, 2014). In view of this book's definition of suicide, which requires an intentional rather than incidental cessation of consciousness (Andriessen, 2006), it is doubtful whether such acts count as suicide anyway for our purposes and will likely give few clues to the evolutionary puzzle. To illustrate with an often-cited scenario, Lankford (2013) argues that a soldier falling on a grenade to protect his comrades would certainly show altruism, but the act could not sensibly be called suicide because self-killing is not its objective.[8] Rather, as with the self-sacrificing behaviours of some hymenopteran insects, the aim is to defend the group, with the actor's own death being only an incidental effect. The overall picture is that it may be rare for suicidality and altruism to co-occur (Townsend, 2007, 2014). Johnson (1965) suggests that, even within Durkheim's own frame of reference, altruistic suicide as a category can be set aside for practical purposes.

No doubt, natural selection should favour altruism when the inclusive fitness payoffs probabilistically outweigh the costs, but there is no obvious logic for the evolution of suicide based on this principle. Lankford formulates the evolutionarily stable winning strategy for humans, and virtually all other mammals; thus, "help your kin – but if doing so will result in your serious injury or death, save yourself instead" (2015, p. 3). What cannot be favoured, argues Pinker (2011) with regard to evolved altruism among humans, "is a willingness to die with certainty, which would take any genes that allow such willingness along with the dead body" (2011, p. 354). In the search for an evolutionary account of suicide, altruism may be the best adaptationist explanation available, but its inability to explain suicide rather than some other outcome, and its empirical and theoretical contraindications, suggest that it is not good enough. It remains hard to dispute the commonsense conclusion that suicide probably is not and never would have been favoured by natural selection.

2.3 Suicide as a Maladaptive By-Product

A genetically heritable trait may become fixed in a population not because it is itself an adaptation but because it is a by-product of an adaptation. To define the distinction, "Adaptations are traits shaped by selection directly; by-products are traits formed by selective pressures indirectly" (Thornhill & Palmer, 2001, p. 163). Could suicide be such a by-product? Certainly there is scientific unanimity about the inevitability of evolved by-products in nature. Darwin himself took care to stress that not every aspect of every product of selection is adaptive, and he alluded to "mysterious laws of the correlation of growth" by which one modification leads to other important, but often poorly understood, changes (1859/1996, p. 12). Natural

[8] As an example of the reverse, Lankford (2013) argues that suicide bombers are probably suicidal but questionably altruistic, notwithstanding alibis that they die for a cause: he suggests that the perpetrators may have private psychopathological reasons for wanting a suicidal escape and that their choice of martyrdom as a method usually reflects not altruism but cultural constraints to self-killing by other means (Gearing & Lizardi, 2009).

selection does not produce wholly favourable outcomes, only outcomes that are favourable on balance (Williams, 1966). It works by making trade-offs, as Mayr (1982) explains:

> There is a cost to every evolutionary advance… and selection determines whether or not the added advantage is worth the cost. The result is that the phenotype is often a patchwork of features that were specifically selected for a particular function (or the answer to a particular selection pressure) and others that are the by-product of the genotype as a whole and are simply tolerated by selection. (1982, p. 590)

Examples of evolutionary by-products abound in nature. Some appear to be cost-free in fitness terms; the whiteness of bones, for example, probably carries no adaptive value in itself. Rather, the colour is a by-product of another system that is adaptive – a calcium-rich composition, which gives bones strength (Symons, 1992). While it is probably no hardship for an organism to have white bones, other evolutionary by-products may not be so innocuous. The human susceptibility to chronic back pain can be assumed to have no direct fitness value, but it can be understood as a noxious side effect of upright posture and bipedalism (Filler, 2007), traits which may have brought so strong a reproductive advantage that, despite the costs, they helped humans to multiply and colonise much of the planet (Leakey, 1994). A susceptibility to suicide might be another such maladaptive by-product: according to David Sloan Wilson, "suicide may be…a necessary cost of behaviour that is advantageous when averaged over all circumstances" (1980, p. 283). But then, as Pitman (1982) notes, if this is true, the need arises for an explanation of what that suicidogenic, yet on average advantageous, behaviour might be. Any claim that a characteristic evolved as a by-product is incomplete unless the adaption that necessitated it is also identified (Goetz & Shackelford, 2007).

If suicide is an evolved by-product, then of what? A search of scientific and philosophical literature suggests that very few researchers, if any, have dealt directly and in depth with this question. Several writers, however, offer tentative suggestions – intuitive, *en passant* ideas from a variety of intellectual positions, including philosophy, psychology, sociology, biology, and psychiatry. Their conjectures can be collected, perhaps arbitrarily, under some general headings: the social functioning of emotional pain, the capacity for learning and behavioural flexibility, the ability to think hypothetically, and human consciousness or self-awareness.

- Possible *social functions of emotional pain* may be relevant. In the context of his ideas concerning the suicidogenic role of thwarted belongingness, Joiner (2005) suggests that while the experience of psychological pain may have brought a fitness benefit to ancestral humans by alerting the individual to threats to vital social relationships (Eisenberger & Lieberman, 2005; Thornhill & Thornhill, 1989), the same pain, as a maladaptive side effect, can also promote suicide (Gunn, 2017).[9]

[9] Joiner's (2005) notion of "thwarted belongingness" recalls Durkheim's (1897/1952) theory that suicide may arise partly from loosened social ties: it is, however, debatable whether the experiences of thwarted belongingness, or indeed other painful emotions, are exclusively human phenomena and hence by themselves explain suicide, an issue to be explored in later chapters.

- DeCatanzaro (1980, 1981) suggests, among other ideas, that the capacities for *learning and behavioural flexibility* helped humans to meet the challenges of fast-changing Pleistocene climates and the diverse environments encountered on our species' dispersal from Africa. While learning and flexibility gave us a degree of independence from biological constraints, these capabilities may at the same time have enabled suicidality and other self-destructive behaviours. The social nature of human cultural learning may connect with the previous point: deCatanzaro (1980, 1981) speculates that our capacity for communication, and other cognitive tools that enable us to live as social beings, may be involved in suicide – the particular phenomenon of imitative suicides might be understood in this light (Humphrey, 2018; Marsden, 1998). From a behaviourist position, Skinner (1969) similarly contends that, in the absence of obvious genetic logic, suicide is likely to be a learned rather than an instinctive behaviour.
- The philosopher Anthony Leeds (1977) argues that suicidality may have arisen in part from the universal human *ability to postulate* – to think hypothetically. Likewise, psychiatrist Antonio Preti (2011) proposes that suicide may be associated with the uniquely human faculties of intentionality and foresight, a proposal similar to that of the psychologist Thomas Suddendorf (2013), who ascribes the capacity for suicide to what he calls *mental time travel*.
- *Consciousness* is considered by several writers to be a unique solution to the adaptive challenges faced by early humans but one that may have brought about new problems, suicide included. Evolutionary psychologists Bering and Shackelford (2004) hypothesise that "suicide… *could not have evolved* were it not for consciousness. Thus we should find no homologous behaviours in closely related species" (2004, p. 282, original italics). Leeds (1977) attributes suicide in part to *self-awareness* specifically – the reflexivity of human consciousness. In the same vein, observing that one commonality shared by young children, non-human animals, and the severely mentally impaired is that they do not suicide, sociologist Jean Baechler writes of suicide being "a privilege of fully self-conscious human beings" (1975/1979, p. 38). Psychologists Nicholas Humphrey (2011) and Andrew Solomon (2014) similarly view suicide as a price our species alone pays for consciousness.

This list is unlikely to be exhaustive – others may have also written on the subject. But it is striking that all the authors that have come at least to this researcher's notice point, apparently independently, towards the same general territory — towards suicidality being a side effect of various facets of the normal, species-typical human mind. They could all be wrong, but a logical theoretical underpinning can be found to the apparent consensus. Given that suicide – the deliberate, intentional cessation of consciousness – appears to be a uniquely human act that by definition involves deliberation and consciousness, then the adaptations that brought it about might reasonably be presumed to relate to the human brain's capacity for deliberation and

consciousness, aspects of the sapience that may be the defining adaptation of our species (Jacob, 1977). Voracek (2006a) makes the point:

> Suicide is a biological anomaly: It is species general in humans but absent in other species. It would therefore be surprising if certain higher cognitive traits, unique to humans, had no role in this unique behaviour. (2006a, p. 242)

These "higher cognitive traits," by the by, may not necessarily be discrete phenomena but aspects of the same unitary psychological faculty, the human psyche (Lester, 2014a).

To draw an interim conclusion, a "by-product" explanation of the evolution of suicide is of provisional interest largely on account of multiple and profound empirical and theoretical difficulties with the only two available alternatives: either that suicide was an adaptation, positively favoured by natural selection because of some direct fitness advantage it supposedly gave to those with the trait; or that suicide was fitness-neutral and spread by genetic happenstance. It strengthens the case for a by-product hypothesis to note that if suicide can best be understood as an incidental outcome of a primary adaptation, then a loose interdisciplinary consensus forms around that primary adaptation's likely identity: from diverse perspectives, the theme emerges that suicide plausibly constitutes a harmful side effect of mankind's unique and overall adaptive, mental faculties.

It is necessary to add a caveat to the Arthur Conan Doyle aphorism that was quoted at the start of this chapter. The favouring of one model over the others in this context is not to imply the certainty of logical induction – that having eliminated the impossible, whatever remains must be true. Evolutionary biology may never be a domain of such absolute knowledge because random genetic and other contingencies make many outcomes that obey the laws of physics, while vanishingly improbable, not absolutely impossible (Dennett, 1995; Sober, 2008). There is, however, a case for finding one account to be substantially more credible given the evidence available – an inference to the best explanation (Harman, 1965).[10]

Missing, however, is a worked-out theoretical framework by which to judge the by-product idea's explanatory coherence. It is unclear, for example, why in evolutionary terms human cognition would necessitate, and on balance be worth, the fitness cost of suicidality. Also unexplained is how the human species would have endured at all while carrying an inbuilt potential for wilful self-destruction. If, as seems the case, all humans share much the same species-general mental equipment (Dobzhansky & Montagu, 1947; Tooby & Cosmides, 1990a), why is it that a suicidal by-product does not eventuate in all of us? What prevents suicide occurring in all but a small minority? Focusing on the by-product notion, the next chapter will begin to explore these questions.

[10] As a philosophical aside, this is also not to say that "suicidality as a by-product" is itself a likely scenario, in the *a priori* sense of being a predictable outcome of evolutionary processes. It may indeed be a highly improbable proposition that nature would produce a suicidal animal by any route. Such are the stochastic influences involved in the course of evolution that, according to Gould's (1989) thought experiment, if the tape of life could be rewound into the primordial past and replayed, a completely different outcome would emerge to the one we see.

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Chapter 3
Suicide as a By-Product of "Pain and Brain"

> *Once you equip a creature with the capacity to think, it is bound to think of other things than you originally intended. Intelligence spreads, even into areas in which it will do us no good.* (McGinn, 1993, p. 133)

The previous chapter narrowed the search for an evolutionary account of suicide to the likelihood that the behaviour arose and has been maintained in the human species as secondary effect of a primary adaptation – a trait which was so advantageous overall for reproductive success that it was worth bearing the fitness cost even of the capacity for wilful self-killing.

The preference for the hypothesis – that the capacity for self-murder came about as a side effect of a primary adaptation – is provisional in part because it awaits the primary adaptation being convincingly explicated. We have some general pointers. It carries weight that thinkers from diverse research disciplines independently intuit that suicidality may have arisen as a concomitant of some evolved aspect of human cognition. To short-list some cognitive faculties potentially responsible, candidates include the experiencing of emotional pain as a warning of endangered social relations (Gunn, 2017; Joiner, 2005), the human capacity for cultural learning and behavioural flexibility (deCatanzaro, 1980, 1981; Humphrey, 2018; Skinner, 1969), the ability to think hypothetically (Leeds, 1977), intentionality and mental time travel (Preti, 2011a; Suddendorf, 2013a), and consciousness or self-awareness (Baechler, 1975/1979; Bering & Shackelford, 2004; Humphrey, 2011; Leeds, 1977; Solomon, 2014).

All of these ideas seem to have *prima facie* plausibility and invite pursuit, and it is hard to know where to begin. A heuristic drawn from EP offers the prospect of further narrowing the search space, highlighting lines of investigation that offer the best chance of success: as a rule of thumb, we can expect to find the signature of past adaptive functionality in present psychological phenomena (Barkow, Cosmides, & Tooby, 1992; Goldfinch, 2015). Specifically, in this case, if a trait has consistently brought suicide in its wake through the course of human prehistory, it would be surprising if a manifestation of that trait were not consistently linked with suicide

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now. On this basis, an intuitive start may be made by considering whether any of the hypothesised cognitive adaptions connect with what is known of the epidemiology of suicide. Consciousness, hypothetical thinking, and learning are all topics that appear in suicidology literature and will be discussed later, but the suggestion that stands out most starkly as a close correlate of suicidality is Joiner's (2005) reference to psychological pain, a risk factor that may go beyond a feeling of isolation that was Joiner's particular focus in originally raising the idea.

Psychological pain can be defined broadly as a "lasting, unsustainable, and unpleasant feeling resulting from negative appraisal of an inability or deficiency of the self," a consensus formulated by Meerwijk and Weiss (2011, p. 402) from the overlapping definitions of several researchers. Psychological pain is effectively synonymous with emotional pain, mental pain, despair, mental perturbation, and torment (Shneidman, 1998; Tossani, 2013), all of which, and more, may all be subsumed in the neologism coined by Shneidman (1993a): *psychache*.[1]

> Psychache refers to the hurt, anguish, soreness, aching, psychological pain in the psyche, the mind. It is intrinsically psychological – the pain of excessively felt shame, or guilt, or humiliation, or loneliness, or fear, or angst, or dread of growing old or of dying badly or whatever. When it occurs its reality is introspectively undeniable. (Shneidman, 1993a, p. 51)

This conflation of varieties of pain is a matter of both ancient human experience and modern neuroscience: summarising pain's neurological continuity, Biro (2010) quotes the Greek philosopher, Antiphanes (c400 BC) – "All pain is one malady with many names."

3.1 Pain: A Biological Motive for Escape Action

The notion that pain generally, and emotional pain in particular, may be evolutionarily adaptive but incidentally suicidogenic is of interest on at least three counts. First, it would appear to fit the epidemiological record. Second, it may point to a powerful selective advantage – the protective function of pain – that would plausibly have been worth even the cost of suicidality. Third, it could explain, uniquely among the explanations proposed so far, the specificity of suicide as a maladaptive outcome – pain, as a biological imperative, is intrinsically designed to motivate action to end or escape it. These points will be explored in turn.

3.1.1 Pain as Suicide Risk Factor

The proposition that some sort of pain is a necessary, but not sufficient, risk factor for suicidality is a point of unanimity, or virtually so, among suicidologists, led by Shneidman's (1985) seminal assertion that unbearable psychological pain is suicide's

[1] The terms psychological pain, emotional pain, mental pain, and psychache are used interchangeably in the following discussion.

common stimulus. To Shneidman the role of pain in suicide is axiomatic: "No pain, no suicide" (2001, p. 151) or, to turn the point around, "suicide is never born out of exaltation or joy" (1998, p. 245). Pain's central role in suicide unifies several widely accepted, comprehensive, correlational models of suicidal behaviour (Selby, Joiner, & Ribeiro, 2014). Some, notably Shneidman's (1993b, 1996) own and Klonsky and May's (2015; Klonsky, May, & Saffer, 2016) three-step theory (see 1.4.2 above), focus on a universal association between suicidality and pain. Other models of suicide highlight links with particular varieties of psychological pain in different blends and sequences, such as thwarted belongingness and perceived burdensomeness (Joiner, 2005); hopelessness, as identified by Weishaar and Beck (1975; 1985; 1992); helplessness, defeat, and entrapment (J. M. G. Williams, 1997); a sense of personal failure, painful self-awareness, and negative affect (Baumeister, 1990); humiliation (O'Connor, 2011); thwarting disorientation (Lester, 2014b; Naroll, 1963); emotional dysregulation (Linehan, 1993); anomie (Durkheim, 1897/1952); and so on. Neurobiological approaches to suicide equally occupy this domain, tracking the social triggers and physiological sequelae of psychological pain (Olié, 2016). The suicidogenic potential of chronic physical pain is also well documented (Hassett, Aquino, & Ilgen, 2014; Hooley, Franklin, & Nock, 2014).

The theoretical consensus around pain as a, or the, universal author of suicide (Shneidman, 1998) is reflected in a matching empirical accord: each of the major theories of suicide that focus on emotional pain finds empirical support in terms of statistical associations (Gunn & Lester, 2014; Selby et al., 2014). The burdensomeness and thwarted belongingness components of Joiner's (2005) interpersonal-psychological theory are often implicated in suicidality, as is the experience of hopelessness (Lester, 2014a; Wenzel & Spokas, 2014). Psychache, as operationalised by Shneidman (1999) into a psychache scale, has been found pre-eminently to correlate with suicide ideation, motivation, preparation, and suicide risk (Campos & Holden, 2015; Campos, Holden, et al., 2016; Patterson & Holden, 2012; Troister, 2014; Troister & Holden, 2010, 2012, 2013; Verrocchio et al., 2016) and mediates other psychological risk factors (Campos, Gomes, Holden, Piteira, & Rainha, 2016). Psychological pain recurs as the most widespread motivating theme in suicide notes across several cultures (Chávez-Hernández, Leenaars, Chávez-de Sánchez, & Leenaars, 2009; Gunn, Lester, Haines, & Williams, 2012; O'Connor, Sheehy, & O'Connor, 1999; Orbach, Mikulincer, Gilboa-Schechtman, & Sirota, 2003; Valente, 1994). Reviewing the evidence, Klonsky and colleagues conclude that the major spur towards suicidality is overwhelming pain, whether mental or physical, aggravated by despair of any change for the better (Klonsky et al., 2016; May & Klonsky, 2013).

3.1.2 Evolutionary Adaptiveness of Pain

There is also robust theoretical and empirical evidence that pain, whether physical or solely mental, has adaptive functionality: the fitness advantage of being able to experience pain would have been favoured by natural selection in the descent of man, perhaps despite a concomitant cost in terms of suicidality.

Certainly, by scientific agreement, *physical* pain is designed to fulfil a biological, protective role, functioning for humans presumably as it does for other animals, to minimise and avert tissue damage (C. Klein, 2007). Pain systems can of course malfunction (Loeser & Melzack, 1999; Wall, 1999), but by design, as "the gift nobody wants" (Brand & Yancey, 1993), physical pain is a self-preserving necessity for life. Pain works because it is an imperative stimulus; it delivers what Corns (2014) dubs "motivational oomph" – it interrupts, distracts, and demands attention (Eccleston & Crombez, 1999). Alongside the bodily sensation, physical pain is intrinsically bound up with emotional content and meaning (Fernandez & Turk, 1992; Gatchel, Peng, Peters, Fuchs, & Turk, 2007; Melzack & Casey, 1968; Melzack & Wall, 1967; Tossani, 2013; Wall, 1979, 1999). Pain is "…always unpleasant and therefore also an emotional experience" (IASP, 1986, p. S217). Physical pain thus mobilises wider emotional systems, giving priority to an urge to escape or obtain relief (Auvray, Myin, & Spence, 2010). Pain can be ignored or overridden, but only for a while: unless and until it is addressed, the signal intensifies, interfering with the processing of other information (C. Klein, 2007, 2015a, 2015b; Van Damme, Crombez, & Lorenz, 2007). The outcome can be beneficial: the emotional drive that arouses in response to biological deprivations or noxious stimuli, focusing attention and narrowing the range of informational cues that can be admitted, often leads to an improved behavioural performance (Easterbrook, 1959). Pain's physical/emotional association may work both ways: psychological pain seems often expressed in somatic symptoms (Halbreich et al., 2007).

In sum, psychological pain and physical pain may be viewed as an integral system (Biro, 2010; Ciompi, 1991, 1997; Faw, 2000) – a point implied by the definition of pain as an "unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage" (IASP, 1994). If physical pain is adaptive, by implication, so is its psychological component.

Psychological pain, psychache, appears also to exist in its own right, however. According both to the neurological evidence (Mee, Bunney, Reist, Potkin, & Bunney, 2006) and to commonplace experience, one can feel very bad without necessarily hurting anywhere in particular. Psychache apparently operates through dedicated neural networks, which may have been co-opted from evolutionarily pre-existing physical pain systems (Eisenberger, 2011, 2012a, 2012b; G. MacDonald, Kingsbury, & Shaw, 2005). Emotional pain appears to be experienced by other animals as well as ourselves and can be traced to deep, prehuman, evolutionary roots: that it endures suggests it is with us for a functional purpose (Ekman, 1992; Panksepp, 1998, 2015; Panksepp & Panksepp, 2000; Panksepp & Watt, 2011). There are two main, partially overlapping, schools of thought on what that function may be. One is that psychological pain may signal damage or a threat to a person's meaning systems – the individual's framework for understanding the world and his role in it. The human brain seems designed to create meaning, in a dual sense of a personal meaning and purpose in life, as well as an overview of cause-effect predictability in the world (Bolton, 1997; Bolton & Hill, 1996). Survival in our deep evolutionary past, as it does now, depended on our grasp of causal regularities in the physical and social environment and on our personal competence as organisms to

operate in it (Hirsh, 2013). Humans might be particularly attuned to cause-and-effect patterns; it may have been our capacity for casual understanding that opened the way to sophisticated tool-using and toolmaking, a unique mark of being human (Wolpert, 2007). When the environment behaves in ways that contradict a person's meaning systems, as may occur in traumatic stress or chronic abuse, then psychological pain may act as a signal of the inconsistency and demand that attention is paid to resolving it (Bolton, 1997). The underlying idea that the psyche is functionally attuned to spot and respond with emotional pain to meaning discrepancies is supported by a large body of empirical evidence and theoretical structure (Hicks & Routledge, 2013).

The other school of thought, most directly connecting to Joiner's (2005) evolutionist suggestion cited earlier, holds that psychological pain may function to signal actual or potential damage to the individual's social relations (Baumeister & Leary, 1995; Bowlby, 1980/1991; G. MacDonald & Leary, 2005; Panksepp, 2014; Papini, Fuchs, & Torres, 2015; Watt & Panksepp, 2009; K. D. Williams, Forgas, & von Hippel, 2005). Bowlby (1969/1997) ventures that the task of regulating attachments was so vital in our ancient evolutionary environment, not just for humans but for mammals generally, that the neural networks of physical pain may have been modified to form a social early warning system, designed to maintain the relationships that the organism relied upon for its survival and reproductive fitness. Human beings' need to belong derives from an evolutionary necessity, as summed up by Baumeister and DeWall (2005, p. 54): "with no fangs, no claws, no fur, other physical vulnerabilities, and a very extended childhood, humans beings are not well suited to living alone in the forest." In the face of such a severe adaptive problem, social animals, and humans especially, would be expected to benefit from powerful mechanisms that alert the individual to inclusion threats and which guide reparative behaviours (Bowlby, 1969/1997, 1973, 1980/1991; G. MacDonald et al., 2005).

According to this second model, supported by the neurological imaging studies of Eisenberger and colleagues (2011, 2012a, 2012b; 2004, 2005; 2003), psychological pain can be understood as primarily *social* pain, defined by G. MacDonald and Leary (2005, p. 202) as "a specific emotional reaction to the perception that one is being excluded from desired relationships or being devalued by desired relationship partners or groups." Rejection literally hurts (G. MacDonald et al., 2005; Panksepp & Watt, 2011). The Thornhills (1989) take a stronger position, arguing that mental pain *is* social pain: their hypothesis, in support of which they cite subsequent studies of the emotional consequences of rape (1990, 1991; Thornhill & Palmer, 2001), is that:

> …human mental pain is an adaptation that functions to force assessment of the circumstances surrounding social problems in the lives of individual humans. The hypothesis views the evolved function of mental pain as analogous to the evolved function of physical pain. Physical pain serves to draw an individual's attention to some aspect of anatomy that needs tending and can be fixed by the individual's attention. Mental pain seems to focus an individual's attention on the significant social events surrounding the mental pain and promotes correction of the events causing the pain and the evolution of future courses of action. (R. Thornhill & Thornhill, 1989, p. 98)

There may be many ways in which emotional pain might be understood to serve this adaptive, social function (K. D. Williams et al., 2005). Nesse (2004) and others propose that emotional distress alerts the individual to failures to achieve social goals. Qualitatively different aversive emotions may signal subtly different threats: specifically, Fessler (Fessler, 2007; Fessler & Gervais, 2010) and Gilbert (1997) argue that the so-called social emotions of shame and guilt may have evolved as signals to regulate the individual's behaviour within pro-social norms, indicating a risk of disapprobation (Sullivan, Landau, & Kay, 2012), or, perhaps with similar effect, to punish the individual for over-prioritising short-term payoffs against long-term social commitments (Haselton & Ketelaar, 2006). The fear of painful rejection can be found across human cultures, although the criteria for exclusion and the experience of social pain may vary from society to society according to prevailing ethical intuitions (Dennett, 1979; Fiske & Yamamoto, 2005; Hartling, 2007; Mishara, 2006). There may also be an important quantitative dimension to emotional pain as a motivator (Tang, Kelley, Hicks, & Harmon-Jones, 2013): Leary and colleagues view mental pain as a calibrated "sociometer," relating the individual's sense of self-esteem to the degree of his social connectedness (Leary & Guadagno, 2011; Leary, Tambor, Terdal, & Downs, 1995; Leary & Toner, 2012). Similarly, the Thornhills (1990, 1991; 2001; 1989) propose that psychological pain is proportional, its intensity reflecting the level of actual or threatened damage done to the individual's inclusive fitness. The idea would seem to have commonsense evolutionary logic: in general, the more severe the threat to fitness, the stronger should be the psychological signal that motivates a response (Alexander, 1986; Mort, Fux, & Lawson, 2015). Even trifling rejections under laboratory conditions have been shown to produce powerful emotional reactions, an extreme sensitivity which points to the gravity of social exclusion as a fitness threat in human evolutionary history (G. MacDonald et al., 2005).

These two hypothesised triggers of psychache as an alarm signal – meaninglessness and social exclusion – are not mutually exclusive and may indeed operate together. The most influential setting for human evolution was probably not so much our ecological or physical environment, but the human social environment (Brothers, 2002; Chance & Mead, 1953; Dobzhansky & Montagu, 1947; Dunbar, 2007b; Humphrey, 1976, 1983; Jolly, 1966): on this basis a human being's meaning system may be primarily concerned with the meaning of social relationships (Baumeister & Vohs, 2002; Cacioppo & Hawkley, 2005). In the other causal direction, social and reproductive success may depend to a large degree on the individual's success in predicting, navigating, and otherwise usefully reading meaning into the environment (Fredrickson, 2001). Either way, whether emotional pain serves to protect social connections, or meaning systems, or both, the capacity to experience psychological pain can reasonably be presumed to have conferred a powerful fitness advantage in human evolutionary history.

The signature of this advantage may be observable today in aspects of human psychological resilience (Kent, Davis, & Reich, 2014) and meaning-making (W. E. Davis & Hicks, 2013): unpleasant though it always is, psychological pain does appear to "work" inasmuch as it can lead to positive learning and reparative

outcomes (Bonanno, 2009; Folkman, 1997; Folkman & Moskowitz, 2000; Hein, 2014; Meerwijk & Weiss, 2011; Morse, 2001; Neimeyer, 2000, 2011; Rehnsfeldt & Eriksson, 2004; Zautra, 2014). The process of working through distressing emotions can be transformative to the extent that Shattell and Meerwijk (2012) suggest it could be unethical for clinicians entirely to suppress an individual's psychological pain. In sum, the adaptive advantage gained from the ability to feel mental pain may be strong enough to override the fitness cost of even so costly a by-product as suicidality (Gunn, 2017).

3.1.3 Suicide as a By-Product of Pain

This notion that suicide may come about as a side effect of psychache offers to shed light on the neglected question of suicide's specificity – why self-murder, rather than some other response, should result from the postulated input or risk factor.

The key may lie in the composite nature of pain, combining as it does two conceptually distinct components (C. Klein, 2015a; Slaby, 2012). One strand is intentional: intentional in this context meaning that pain has meaning – it refers to and represents something in the world, an actual or perceived threat that requires attention. The other is hedomotive (Bain, 2013) or affective-motivational (Auvray et al., 2010): pain motivates action because it is intrinsically bad, and the hurt of pain imposes a new action priority – to end it (Eccleston & Crombez, 1999). Extreme pain may have the effect of temporarily blocking access to longer-term memory and the capacity for reflective thinking, because a single overriding imperative – "Stop the pain!" – takes over (Reisch et al., 2010; B. M. Wagner, 2009).

Emotional pain is reported to be particularly demanding: in comparison with physical pain, it is experienced to be at least as unendurable and often worse (Biro, 2010; G. MacDonald & Leary, 2005; Meerwijk & Weiss, 2011; Osmond, Mullaly, & Bisbee, 1984). Neurological imaging studies suggest that psychache operates in the brain to compel action along similar neural lines to physical traumatic stress, producing a short-term, goal-directed behaviour focused on ending what is a subjectively unbearable condition (Michel & Valach, 2001). As likely evolutionary homologues (Eisenberger, 2011; G. MacDonald et al., 2005), psychological and physical pain seem to produce similar effects of cognitive rigidity and constriction: painful emotions narrow the range of perception and thought (M. C. Davis, Zautra, & Smith, 2004; Easterbrook, 1959; Öhman, Flykt, & Esteves, 2001; Reich, Zautra, & Davis, 2003). To Bowlby (1973), it is this aversive element that makes emotional pain effective for promoting social survival, it makes for a fast reaction, it leaves a lasting impression in conditioned learning, and it thereby motivates the individual to avoid pain-triggering cues in the future (G. MacDonald & Leary, 2005). The compulsion to stop pain by escaping from it appears to be both a basic animal response (Wechsler, 1995) and a human one. "Pain is nature's great signal," writes Shneidman (1996, p. 7): "Pain warns us; pain both mobilises us and saps our strength; pain, by its very nature, makes us want to stop it or escape from it."

Suicidality may be understood as a maladaptive outcome of the potential conflict between these dual biological roles of pain. The intentional message of pain conveys a meaning which seeks to be addressed, but the imperative to relieve the suffering takes precedence (Baumeister & Vohs, 2002), a demand that can become so urgent that an escape into oblivion may appeal (K. J. Kaplan & Bratman, 2000; Klinger, 1977; Mikulincer, Florian, Birnbaum, & Malishkevich, 2002; Mikulincer, Florian, & Hirschberger, 2003). Many suicidologists believe suicide may constitute a drastic but effective way to satisfy the requirement to end pain without having to, or where it seems impossible to, address its source (Baechler, 1975/1979; Baumeister, 1990; Douglas, 1980; Gunn, 2014; Maris, 1981; Shneidman, 1993a, 1996, 2005). According to this model, a compulsion to obey the affective-motivational demand of pain arises from a general avoidance reflex (Neuringer, 1974). The cognitive constriction believed to characterise the suicidal state (Leenaars, 1992, 1996; Shneidman, 1993a) may be understood in this light, as an outcome of pain's normal, evolved functioning – narrowing the scope of perception and thought and imposing an overriding cognitive and behavioural priority to escape. The constricting cognitive effect shared by psychological and physical pain, as evolutionary homologues (Eisenberger, 2011; G. MacDonald et al., 2005), might aid an understanding of the dichotomous thinking and mental rigidity that is associated with the suicidal state of mind (Neuringer, 1964, 1967; Shneidman, 1996; Wenzel & Spokas, 2014).

The unidimensional painfulness of pain may also shed light on the canalisation of diverse inputs into a specific suicide outcome – the universal painfulness of pain provides a singular biological basis for its suicidogenic force. As was noted earlier in this section (3.1 above), Shneidman (1993a, 1993b, 1998) posited psychache as an umbrella concept, encompassing shame, guilt, despair, grief, humiliation, loneliness, fear, and any other variety of unendurable psychological torment. For the organism, in order to prioritise action, it may be a matter of informational necessity to unify these and other disparate experiential states into a single measure of aversiveness. Humans, like other animals, can typically do only one thing at a time – feed, flee, defend territory, copulate, and so on: this practical constraint requires that competing candidate behaviours are traded off, choices weighted by a common criterion, to arrive at a behavioural final common path (McFarland & Sibly, 1975). For this reason, aversive and appetitive emotional states, although they can be experienced independently (Bradburn & Caplovitz, 1965; Cacioppo & Berntson, 1994; Folkman, 1997; Tops, Boksem, Luu, & Tucker, 2010) and follow different neural tracks (Gray, 1989; Panksepp, 1998; Porges, 2009), can be understood to collapse onto a single hedonic continuum (Young, 1959). Emotional states carry a basic good/bad valence (L. F. Barrett, 2006; Russell, 2003), a common currency of pain/pleasure by which behavioural decisions can be made and motivated (Cabanac, 1979, 2010; McNamara & Houston, 1986). It follows that, regardless of the sundry causes and qualities of pain and its manifold names, the fundamental unacceptability of pain can be expected to drive a channelled escape response. As Shneidman (1998) explains, it is the degree, rather than the variety, of pain that makes it suicidogenic:

> For the suicidal person, that psychological pain, that pain in the mind, that *psychache*, has a quantitative intensity that pushes it into a special qualitative state; it is deemed unbearable, intolerable, unacceptable; it has crossed a certain critical line somewhere in the mind. (1998, p. 248, original italics)

To draw a provisional conclusion, suicide would appear to be not evolutionarily adaptive but psychologically adjustive (Shneidman, 1985): it successfully terminates pain. Pain, on the other hand, probably is adaptive on average: it is an evolved internal stimulus which, notwithstanding a suicidal side effect, promotes the organism's self-preservation. Psychological pain, which can arguably be more intolerable than physical pain, seems designed to help protect the organism's vital social relations and meaning systems. Thus, offering an explanation which seems to fit both the principles of evolution and what we know of the epidemiology of suicide, the human experience of psychological pain may be understood as an evolved adaptation that brought with it suicidality as a maladaptive by-product.

3.1.4 Inadequacy of Pain Alone as a Condition of Suicide

And yet, while emotional pain may be a necessary condition of suicide, motivating a suicidal escape, it is evidently insufficient. While we cannot be certain of others' subjective experiences, commonplace observation is that most, perhaps all, humans know emotional pain, but very few respond by taking their own lives.

The inadequacy of emotional pain alone to explain suicide is highlighted most strongly by the likelihood, noted already in the discussion of the evolutionary origins and adaptive functionality of psychache, that emotional pain is not anyway an exclusively human experience. Other animals seemingly have feelings as much as we do, an equivalence that Darwin observed and documented in *The Expression of the Emotions in Man and Animals* (1872/1965). Supporting the cross-species common ground that Darwin posits, Bowlby (1969/1997, 1973), the pioneering explorer of the social roots of psychological pain, theorises that the same affective consequences of attachment and loss would play out among human and non-human mammals alike. Indeed these affective dynamics have arguably been studied more closely in monkeys than in people (Suomi, 1995, 1997). Strong emotions and social emotions in particular – loneliness, grief, and sadness – manifest themselves in modern neurological studies of non-human mammals (Panksepp, 1998, 2015). The inference that similar affective neural structures and the capacity for raw emotions may be homologous across species (Panksepp, 2008) leads neuroscientist Paul McLean (1993) to the view that the upsetting experience of separation is part of the mammalian condition – it is what "makes being a mammal so painful" (1993, p. 74). And yet, despite showing signs of pain and unhappiness perhaps as much as humans do, non-human animals appear to have immunity from suicide (Comai & Gobbi, 2016). One or more additional factors are required to explain why humans alone may respond to pain by self-killing.

3.2 Brain: Human Cognition Provides the Means to Escape by Self-Killing

So the search for an answer to the question "Of what is suicide a by-product?" needs to go beyond the evolution of pain. Some uniquely human adaptation or adaptations, added to the experience of pain, can be presumed to be involved. To guide an intuitive start to the search for candidates, we can recall, first, the EP heuristic, that present psychological patterns can be expected to retain marks of their past adaptive function (Barkow et al., 1992; Goldfinch, 2015). We can recall, second, the array of cognitive capabilities suggested by various writers to be responsible for suicidality's existence in the human species – the capacity for cultural learning (deCatanzaro, 1980, 1981; Humphrey, 2018; Skinner, 1969), hypothetical thinking (Leeds, 1977), foresight and intentionality (Preti, 2011a; Suddendorf, 2013a), and consciousness (Baechler, 1975/1979; Bering & Shackelford, 2004; Humphrey, 2011; Leeds, 1977; Solomon, 2014) – accepting that these ideas may not reflect the existence of separate faculties but may, rather, be different perspectives of the same mental entity. Combining the two points, the question arises whether the epidemiological record points to suicide as a side effect of general human cognitive sophistication.

The developmental pattern of suicide would seem to point towards an answer. Particularly striking is the extreme rarity of recorded suicides among young children (Pfeffer, 1986; Shaffer & Fisher, 1981). The existence of this large, distinct group of humans with virtual immunity from suicide suggests that a developmental condition is necessary for suicide to occur. Before discussing the likely reasons for this protection, it will help as background to review the pattern of suicide in early years.

3.2.1 Epidemiology of Child Suicide

Suicides among pre-pubescent children, while not unheard of (Hezel, 1987; Pfeffer, 1986; Pompili, Vichi, De Leo, Pfeffer, & Girardi, 2012), are very unusual. To illustrate, out of some 40,000 total US suicides in 2012, just 311 were aged 5–14, and there were none younger (Murphy, Kochanek, Xu, & Heron, 2015). A marked discontinuity occurs in the number and rate of suicides in adolescence and early adulthood: Shaffer and Fisher (1981) describe the pattern as a moderate underrepresentation of suicides in the 15–19 age group and a very considerable underrepresentation among 10–14-year-olds. In a skew masked by age-banded data, what few suicides there are among under 15s are tightly compressed into the upper, 13–14, end of the age range (Beautrais, 2001). It might be argued that this picture could be an artefact of systematic underreporting, perhaps reflecting a reluctance of official recorders to attribute the cause of child deaths to suicide: but, as Shaffer and Fisher (1981) note, even if all "undetermined" verdicts and an arguable share of accidental deaths were included, the number of pre-pubertal suicides would still be very low.

Consistent with the graph for suicide deaths, other, sublethal measures of suicidality – ideation, planning, and attempts – follow a similarly shaped curve. From a survey of adolescents in the USA, Nock et al. (2013) found very few, if any (<1%), reported having seriously thought about taking their own lives before the age of 10; the percentage grows slowly to age 12 and then accelerates through the teen years. The first onsets of suicide planning and attempts show a similarly very low prevalence (<1%) until age 12 and growth thereafter (Nock et al., 2013).[2] This trajectory of childhood suicidality appears to be broadly consistent cross-nationally, both for suicidal deaths (Shaffer & Fisher, 1981) and for suicidal ideation, planning, and attempts (Borges et al., 2012; Moch, 1969; Nock et al., 2008). It also shows stability over time, as indicated in Mulcock's (1955) analysis of England and Wales statistics for the period 1938–1953: Mulcock found, in his words, a "sudden and dramatic spurt" in suicides at around 14 years of age, an acceleration at around puberty that remained constant through the war years, in contrast to striking variations in adult suicidality over the period. The overall picture is that nil or close-to-nil suicidality in early childhood, followed by a sharp increase in early teenage years, appears to be an enduring and cross-cultural human phenomenon: as Shaffer and Fisher (1981) deduce, it points to the existence of a universal factor or factors conferring protection among preadolescent children.

3.2.2 Factors Hypothesised to Protect Children from Suicide

What protects preadolescents from suicide? Shaffer and Fisher (1981) offer three suggestions: first, depressive illness, a suicide risk factor, may be less prevalent among young children; second, the presence of a family structure may provide support and reduce isolation; third, thinking about, and carrying out, suicide may require a level of cognitive maturity that normally takes until adolescence to develop. All three possibilities have some evidential backing and will be considered in turn.

First, mental illness generally and those psychopathologies most associated with suicidality in particular are indeed less prevalent among young children (Kessler et al., 2007), and the childhood suicides that do occur have been associated with the onset of certain psychiatric diagnoses, notably depressive disorders (M. S. Gould, Greenberg, Velting, & Shaffer, 2003; Pfeffer, 1986; Shaffer et al., 1996). This relationship between mental disorders and suicidality mirrors what is found in the general population: some 90–95% of suicides have been linked with a psychiatric

[2] It can be noted in passing the perhaps surprisingly high prevalence of suicidal ideation and behaviour among teenagers: about 1 in 6 US 18-year-olds self-reports that they had seriously thought about killing themselves, and 1 in 20 had tried (Nock et al., 2013). Brezo et al. (2007) found even higher rates in a survey of young adults in Quebec: by age 20, one in three had seriously considered suicide, and nearly one in ten had made at least one attempt. Encounters with suicidality are apparently so common among teenagers that it may be regarded as a normal part of adolescence (Kessler et al., 2012). This pattern would further contradict a characterisation of suicide as analogous to a late-onset disorder (deCatanzaro, 1981; Voracek, 2006a).

diagnosis (Cavanagh, Carson, Sharpe, & Lawrie, 2003), although this association may be less strong in non-western cultures (Hvistendahl, 2012), and most mental disorders correlate with heightened suicide risk (Chesney, Goodwin, & Fazel, 2014; Harris & Barraclough, 1997). Depression is a particular risk factor, linked to around 50% of suicides, and those with depressive illnesses are many times more likely to take their own lives compared to those without (Rihmer, 2011).

Noteworthy though these epidemiological connections are, they fall short of a satisfactory explanation for the rarity of suicide in early childhood. Most people with depression, at any age, do not suicide – as indeed can be said of the sufferers of any other mental disorder (Satcher, 1999): as Seiden (1969) pointed out in a meta-review nearly 50 years ago, no modern researchers contend that mental disorder is either a necessary or sufficient cause of suicide. Depression, anyway, predicts suicide only insofar as it predicts suicidal thinking (Bruffaerts, Kessler, Demyttenaere, Bonnewyn, & Nock, 2015; Kessler, Borges, & Walters, 1999; Nock et al., 2012; Nock, Hwang, Sampson, & Kessler, 2010) – other factors, such as access to lethal means, come into play in order for suicide ideation to graduate into an actual suicide attempt (Dhingra, Boduszek, & O'Connor, 2015; Klonsky & May, 2014, 2015; Klonsky et al., 2016). As for the nature of the causal connection between depression and suicidality, many hypotheses have been posited (Mishara & Chagnon, 2011), but despite decades of close study, no one has yet been able to explain *how* depression (and, for that matter, mental disorders generally) and suicide are related (Hjelmeland, 2013). This missing causal link recalls, once again, the general complaint made by Atkinson (1978) about correlational suicide theories that omit to explain why the posited input condition should lead to suicide rather than some other outcome. There is the further problem for the purpose of this inquiry that to cite the rarity of depression among preadolescent children as an ultimate reason for their non-suicidality serves merely to shift the burden of explanation along the causal chain: an additional account is then required from an evolutionary perspective to explain why children are protected in turn from depression and indeed why depression occurs at all, questions which also so far lack consensus answers (Allen & Badcock, 2006; Faucher, 2016; Hagen, 2011; Uher, 2009; Varga, 2012). In the absence of a coherent causal explanation, the statistical relationship between childhood suicidality and depression merely tells us, unsurprisingly, that a population with a low rate of suicide (children) tend to lack a factor linked with a high rate of suicide (depression). That said, an explication of the correlation between depression and suicidality may well be relevant to a full understanding of suicide's evolution and will be discussed in later chapters.

As for Shaffer and Fisher's (1981) second proposal, it may reasonably be argued that the presence of a family network may in general provide a degree of protection for children. Social isolation has indeed been associated with suicidal behaviour among adults (Trout, 1980) and among adolescents (Rutter & Behrendt, 2004). Conversely, the perception of family support does appear in general to have a buffering effect, moderating the impact of other suicide risk factors (Johnson, Wood, Gooding, Taylor, & Tarrier, 2011). These are no doubt important and complex associations. However, it strains credibility to claim that family support explains near-zero suicidality among young children. Families are not, of course, universally

supportive, a sad reality manifest in widespread cases of child maltreatment. To illustrate, in 2012, while just 311 suicides aged under 15 were recorded in the US (Murphy et al., 2015), no fewer than 608,814 under 15s were recorded as victims of neglect or abuse, committed in the main by close family members. 1,269 of these children died from the mistreatment, mostly at the hand of their own parents (US-DHHS, 2013). The evidence suggests that what rare suicidality occurs among children is more likely to be aggravated by, rather than to happen in spite of, their family situations (Corder & Haizlip, 1984; Hollis, 1996; Martin, Rotaries, Pearce, & Allison, 1995; Orbach, 1988; Shaffer, 1974).

The third suggested explanation, that children rarely suicide because of their cognitive immaturity, would seem to carry more weight. It is evidenced, according to Shaffer and Fisher (1981), by two broad fields of research. Firstly, to think meaningfully about suicide presupposes a mature understanding of death (Cuddy-Casey & Orvaschel, 1997), an abstraction that appears in turn to require the development of the logical thinking characterised by Piagetian formal operations (Koocher, 1973; Piaget, 1950). Secondly, to carry out a suicidal act appears to require a degree of foresight, planning, and general organisational competence, what Baechler (1975/1979) describes as a minimal capacity to combine thoughts and actions, that younger children may not yet have acquired (Shaffer, 1974). These two theoretical threads – understanding, and practical competence – will be discussed in turn: they point to a central role of general cognitive ability in forming the capacity for suicide.

3.2.3 Understanding Death, Personal Mortality, and the Concept of Self-Killing

One can suppose, by definition, that in order for someone to intentionally kill themselves, then they need to have a meaningful prior concept of what it is they intend – death, of the self, by self-killing. As adults, it may be easy to overlook the intellectual accomplishment this threefold conceptualisation entails. It appears to take most children until about age 12–14 to learn most of the essential realities of death – its finality and permanence (Lansdown & Benjamin, 1985; Pfeffer, 1986; Speece & Brent, 1996): it may take longer for most children to grasp the additional idea that these attributes of death apply to the self and, further, that the self has the ability to bring about its own extinction. The following three sections explore these steps towards possession of an intellectual comprehension of suicide.

3.2.3.1 Understanding Death

By all accounts, the acquisition of an accurate understanding of death is a long and complicated business (Corr & Corr, 2003). The process has been researched closely for many decades. A pioneering study by Schilder and Wechsler (1934) among

psychiatric patients aged 4 to 15 found that, for younger children, the idea of death has little practical meaning – it does not enter their fundamental concept of existence. Two distinct dimensions of death awareness surfaced from that study that have characterised most of the research since: first, that it has subcomponents — death is not a unitary idea but a composite of several ideas;[3] and, second, that it follows a developmental progression — children's attitudes to death emerge and shift, and differ from those of adults in some characteristic ways. Along these lines, in a classic paper, Nagy (1948) finds that children's beliefs about death progress in three broad stages: children up to about 5 see death as a transient event (a dead person lives on somewhere); older children, up to about age 9, tend to personify death as, perhaps paradoxically, a living character (an angel, a monster, a bad man, and so on)[4]; and only at around age 9 does the finality and universality of death begin to register. Expanding on this and other research, Speece and Brent (1984, 1996) emphasise four distinct constituents of death awareness – its universality, irreversibility, non-functionality, and causality. Some of these parts can be broken down still further. Exactly in what order and at what stages the various pieces of the jigsaw fall into place is unclear, because research findings vary (Stambrook & Parker, 1987). To illustrate, there are conflicting views on which component comes last: Bonoti, Leondari, and Mastora (2013) suggest that it may be death's causality – understanding the mechanisms by which vital bodily functions fail arguably being most complex element of death awareness. Nagy (1948) on the other hand proposes rather that the universality of death is the last arrival, typically sometime after age 9. Others posit that death's finality may be the last sub-concept to be understood – usually not before age 10 (Frederick, 1978) and more likely around age 13–14 alongside Piaget's (1950, 1971) developmental stage of formal operations, marked by the capacity for hypothetical thinking and a recognition of the objectivity of reality (Pfeffer, 1986). Whatever the precise sequence, there is a consensus that it takes until around the early teen years for most children to grasp the central facts of death (Lansdown & Benjamin, 1985; Pfeffer, 1986; Speece & Brent, 1996).

3.2.3.2 Understanding Personal Mortality

To think meaningfully about suicide can be presumed to require more than a coherent concept of death in general but, additionally, that the concept applies to the self – in other words, an awareness of one's own personal mortality. Death in the

[3] Schilder and Wechsler (1934) found, notably, that their subjects had difficulty understanding death's finality and irreversibility, a misbelief of particular interest to researchers at the time out of concern that children might be more prone to suicide if they felt death was not the end. As Shaffer and Fisher (1981) point out, the more salient question raised by the epidemiological data is not so much why a tiny number of children, and only older children at that, suicide, but what protects the vast majority.

[4] This personification of death has not been found by subsequent researchers (Speece & Brent, 1984, 1996).

abstract and the death of one's self are apparently distinct intellectual domains: Schilder and Wechsler (1934) found that their child subjects could readily, and fearlessly, take on board some ideas of death, but only as something that happens to other people, not themselves – a blind spot that may be connected with the egocentricity of children's thinking (Noppe & Noppe, 1997). A mature self-awareness of death continues to develop beyond childhood into late adolescence with the gradual lifting of a sense of special immunity – described as a "tattered cloak of immortality" (Gordon, 1986) and a "personal fable" (Elkind, 1967) – often informed by experiential exposure to the deaths of others (Balk & Corr, 1996).

The cognitive complexity of this process may be illuminated by Hofstadter's (1981, p. 31) paraphrasing of Socrates' famous syllogism, which construes the awareness of personal mortality as the outcome of a synthesis of distinct philosophical sub-assemblies:

All human beings are mortal
I am a human being
Therefore… I am a mortal

The first element, the major premise, an understanding of the universality of death, links with one of the four sub-concepts of death identified by Speece and Brent (1996) and others: as discussed already, this conceptualisation alone can be considered a major intellectual feat, typically taking a decade or more to reach. To Hofstadter (1981), the minor premise, *I am a human being*, is no trivial achievement either, requiring as it does an understanding of classes – a form of advanced intelligence that Hofstadter places at the core of human cognition and which Piaget (1950, 1953, 1957) observes to cause much confusion to children at least until about age 8. Hofstadter (1981) argues that, in order to arrive at *I am a human being*, two distinct classes of man (*I* and *human being*) must first be separately identified and then mapped onto each other. Only then can the mind work towards the deduction *Therefore I am a mortal*, a step that to Hofstadter presupposes another sophisticated form of cognition – abstract, logical thinking. Hofstadter's deconstruction of the process supports Kastenbaum and Aisenberg's (1972) construal of personal mortality as an abstraction built from abstractions, a synthesis of concepts and cognitive skills, including the self, logical thinking, probability, necessity, causation, time, and finality. The eventual *Therefore I am a mortal* conclusion appears to dawn on most people sometime during the teen years (Fenczyn, 2004; Kastenbaum, 1967) – or, rather, as Hofstadter (1981) puts it, it "slaps us on the face." Tillich (1951) dubs this experience the ontological shock.

3.2.3.3 Understanding Self-Killing

It would seem, then, to require significant mental competence to conceive of death and more to conceive of one's own death; and yet even these conceptions may not be sufficient to mentalise suicide, which requires the additional ability to conceive of the suicidal act. Meaningful suicidal ideation might be considered from the

perspective of intentionality, intentionality in this context having its philosophical meaning; it is:

> …what allows some of a human being's states of mind – the so-called 'propositional attitudes' (such as beliefs and desires) – to be about (or represent) non-mental and mental things and states of affairs, some actual, some possible, and some impossible. (Jacob, 1997, p. 1)

Behind what looks like a philosophical technicality is the everyday human experience of intentionality – our being "conscious of…" or "aware of…" things, events, ourselves, other persons, and indeed "anything else we bring before our minds" (McIntyre & Smith, 1989, p. 147). Dennett (1989), Dunbar (2004), and others point to the significance of there being a rank order of intentional states: by this scheme, bacteria and presumably insects constitute zero-order intentional entities as they have no awareness of the contents of their own minds, if indeed they have minds. For developing humans, cognitive maturation can be seen as a progression through successive orders of intentionality. A newborn baby, probably along with other mammals, is presumed to have some awareness of the contents of its mind, if only at a basic level of knowing it is, say, cold or hungry, and it hence operates at a first degree of intentionality. By the age of 4 or 5, children acquire a second-order intentionality, beliefs about other people's beliefs (Baillargeon, Scott, & He, 2010; Wimmer & Perner, 1983): they have a "theory of mind" – an ability to mind-read, a faculty found certainly in humans, arguably in adult chimpanzees (Gallup, 1970; Mitchell, 1997; Povinelli & Prince, 1998; Woodruff & Premack, 1979) and possibly in orangutans (Gallup, 1982). Humans alone, so it seems, go on to develop third-order intentionality – "You thought I meant…" – thereby enabling the apparently unique human behaviour of teaching (Galef, 1992). With each added level, the possible permutations of what "he thinks she thinks he thinks…" multiply; thus orders of intentionality can be taken as a useful proxy measure of cognitive complexity (Dunbar, 2004). A capacity for increasingly sophisticated intentionality continues to develop beyond childhood and through adolescence (Blakemore & Choudhury, 2006; Bosco, Gabbatore, & Tirassa, 2014; Dumontheil, Apperly, & Blakemore, 2010) along with the physiological maturation of the brain (Moriguchi, Ohnishi, Mori, Matsuda, & Komaki, 2007; Powell, Lewis, Dunbar, García-Fiñana, & Roberts, 2010). Dunbar (2004, 2007a) suggests that fifth-degree intentionality is the limit for most adults.

Self-consciousness, "an organism's capacity for second order representations of its own mental states" (Gross, 2013, p. 65), is a form of intentionality that is uniquely advanced in human cognition. Natsoulas (1998) illustrates the unique richness of human self-consciousness with C S Lewis' commonplace experience of "the internal witness":

> Man might be defined as a reflexive animal. A person cannot help thinking and speaking for himself as, and even feeling himself to be (for certain purposes) two people, one of whom can act upon and observe the other. Thus he pities, love, admires, hates, despises, rebukes, comforts, examines, masters or is mastered by "himself". Above all he can be to himself in the relation I have called consciring. He is privy to his own acts, is his own conscius or accomplice. And of course this shadowy inner accomplice has all the same properties as an external one; he too is a witness against you, a potential blackmailer, one who inflicts shame and fear. (Lewis, 1967, p. 187)

This self-consciousness may be instrumental in emergent suicidality in developing humans (Hustvedt, 2013), and by a number of possible mechanisms. Self-awareness not only makes the self aware of experiencing psychological pain, but it may itself induce psychological pain (Duval & Wicklund, 1972, 1973; Geller & Shaver, 1976; Silvia & Duval, 2001) and suicidal ideas (Selimbegović & Chatard, 2013). Baumeister (1990) theorises that suicide may be understood as a means to escape from this painful self-awareness, citing as first-hand testimony the self-absorbed nature of suicide notes (Henken, 1976; Ogilvie, Stone, & Shneidman, 1983). Circumstantial evidence supporting Baumeister's (1990) model comes *inter alia* from the increase in suicidality that occurs particularly during adolescence, alongside a growing capability for the mind's eye to look back on itself (Chandler & Carpendale, 1998). This emergence can be viewed both as a quantitative heightening of self-awareness (Schwartz, Maynard, & Uzelac, 2008; Tice, Buder, & Baumeister, 1985) and as the development of a qualitatively novel kind of self-consciousness characteristic of the adolescent life stage (Elkind, 1967).[5]

To assess the cognitive resources required for a decision to take one's own life, it may be instructive to consider how many orders of intentionality are involved. There may be no definitive answer, but a sequence of nested introspections might tentatively be arranged as follows:

1st I feel pain.
2nd I am aware that I feel pain.

This second order of intentionality recalls Shneidman's (1985, 1993a) definition of psychache as "the pain of feeling pain."

3rd I need to escape painful self-awareness.

At this third level, the desire to escape aversive self-awareness offers a motivation for suicide, according to Baumeister's (1990) model, but it is not in itself sufficient: there are, at least at this stage, other, sublethal means of escaping selfhood (Baumeister, 1991).

4th I believe my death would answer my need to escape my painful self-awareness.

To Shneidman, the lethality of suicide lies in this emergent "*idea* of death (nothingness, cessation) as the solution" (1996, p. 8, original italics). In other words, it is not the aversiveness of psychache that kills, but the idea of suicide as an available means of escaping it (Kral, 1994). The position could be abbreviated to, "I can stop this pain; I can kill myself" (Shneidman, 1996, p. 8). And then finally a decision:

5th I must act on my belief that my death would answer my need to escape my painful self-awareness.

Or, put simply, if with defective logic, "Therefore I must kill myself" (Shneidman, 1982).

No doubt other formulations could be proposed, perhaps with one or two steps fewer. For example, a similarly convoluted self-referencing appears in

[5] But see Rankin et al. (2004).

Schopenhauer's assessment of suicide: it constitutes, he says, "a kind of contradiction in that it involves the individual will's wilfully seeking to exterminate itself as a way of escaping the wretchedness of willing" (Trogan, 2013, p. 5). But however the thought process is precisely modelled, it points to the conclusion that to contemplate the deliberate taking of one's own life involves a level of intentionality that is probably beyond the cognitive wherewithal of young children.

3.2.4 Organising Suicide

Moving on to Shaffer and Fisher's (1981) suggested second protective element, it may be that the organisational competence needed to arrange a suicide may be rare among younger children. Shaffer (1974), in his study of suicides among 12–14-year-old children, was struck by the planning and foresight that most had demonstrated: for example, those who had asphyxiated themselves with coal gas had typically made special plans to gain access to an empty house, created alibis to avoid suspicion, carefully sealed windows, and positioned themselves to inhale a lethal concentration within the time available. Those who hanged themselves had acquired the necessary technical understanding of ropes, knots, and ligatures. In the few apparently unplanned suicides, the children had mostly been intoxicated at the time, to the extent that Shaffer (1974) questions their intent. The premeditated nature of suicides generally leads Joiner (2005) to factor an essential "acquired ability" component into his interpersonal-psychological theory of suicide (IPTS), on the evidence that the suicidal act is generally the culmination of a protracted period of planning: people visualise the suicide scene in detail, develop plans, and prepare carefully. Suicide usually requires some planning at least for the practical reason that it is usually difficult to do (Joiner, 2005, 2010; Smith & Cukrowicz, 2010). Physically, as Joiner et al. (2009, p. 636) put it, "the body is generally not designed to cooperate with its own early demise." Among several illustrations, Joiner (2005) recounts the diary entry of one attempted suicide:

> I wonder why all the ways I've tried to kill myself haven't worked. I mean, I tried hanging; I used to have a noose tied to my closet pole. I'd go in there and slip the thing over my head and let my weight go, but every time I started to lose consciousness, I'd just stand up. I tried to take pills; I took 20 Advil one afternoon, but that just made me sleepy. And all the times I tried to cut my wrists, I could never cut deep enough. (Joiner, 2005, p. 53)

The passage concludes: "That's the thing, your body tries to keep you alive no matter what you do."[6] Presumably a certain intellect is required to organise strategies to overcome such obstacles. Young children, however, are not good organisers: Gopnik (2010) infers from hers and others' research that the normal neurological develop-

[6] It seems that the mind resists too: Joiner et al. (2009) describe the effect of self-harm as a progressive mental acclimatisation to the idea of suicide, enabling the mind to "stare down the self-preservation instinct" (2009, p. 3). This point, and the debatable existence of such a generalised instinctual mechanism, will be reviewed in later chapters.

ment of children may be designed actively to inhibit planning – that their long period of dependence may function at least in part to leave children free to focus on flexible learning while the prefrontal cortex wires itself. This difficulty with planning would be expected, among other things, to inhibit the ability to organise suicide.

3.2.5 The Cognitive Floor for Suicide

From this account, the evidence seems to lend most support to Shaffer and Fisher's (1981) third hypothesis that it is cognitive immaturity that protects young children from suicide: an inability meaningfully to conceptualise death, personal mortality, or suicide and a difficulty with organising an effective suicidal act. No doubt, painful life events are important as inputs,[7] but the very few pre-pubescent children who take their own lives can be characterised as not only troubled but also cognitively precocious (Corder & Haizlip, 1984; Mishara, 1999; Shaffer, 1974). The link between cognitive capability and suicidality continues into adolescence (Brent, Baugher, Bridge, Chen, & Chiappetta, 1999; Nanayakkara, Pullagurla, & Pavuluri, 2012), with the vulnerability to suicide rising steeply alongside an increasing skill in abstract and symbolic thinking (Balk & Corr, 1996; B. M. Wagner, 2009; B. M. Wagner & Zimmerman, 2006). Into adulthood, suicidality continues to be associated with higher intellectual functioning, although the reasons are unclear and probably complex (Delisle, 1986; Voracek, 2004, 2006b). Gunnell, Magnusson, and Rasmussen (2005), based on data from Sweden's military conscript register, find suicide risk to be heightened for people at both high and low extremes of intelligence, the greatest risk occurring among poorly performing offspring of well-educated parents.

In the same way that young children apparently are, adults with intellectual disabilities (ID) may be protected by their cognitive limitations, although data on suicidality in this population are sparse. Those with mild ID, thought to be capable of some understanding of suicide, may be as much at risk of suicidal thoughts as the general population – and possibly more so in view of the social stresses of their conditions (Merrick, Merrick, Lunsky, & Kandel, 2005; Mollison, Chaplin, Underwood, & McCarthy, 2014; Patja, 2004; Salvatore et al., 2016), although a lower rate of actual suicide mortality may prevail compared to the general population (Giannini et al., 2010). Among those with moderate to severe ID, however, while there have been documented threats and arguable attempts, completed suicides are all but unknown (Hurley, 2002; Lunsky, Raina, & Burge, 2012; Merrick et al., 2005).

Cognitive incompetence would also reasonably be expected to account for the absence of observable suicides among non-human animals (Preti, 2007). The first of

[7] For example, neurological studies of adolescents have linked suicidality to traumatic life events, which can at critical times influence neurological development (Zalsman, 2010).

Shaffer and Fisher's (1981) two lines of cognitive protection – the inability to conceive of death or personal mortality – would presumably pertain as much to non-human animals as it does to human infants. This is not to say that non-humans cannot distinguish the alive from the not alive: this discernment may be essential for assessing whether, among other things, an object may or may not pose a predatory threat (H. C. Barrett, 2005). It is not to say either that animals do not grieve over a loss (Bekoff, 2000; Bowlby, 1969/1997). Rather, it can be taken as logical prerequisite that, before it can plan its own death, an animal must mentally represent its own death (Preti, 2011b), and there is no evidence that non-humans possess sufficient comprehension either of death generally or of their own mortality to be able to do this (Buss, 1997). As Darwin posits, "no animal is self-conscious if by this term it is implied that he reflects on life and death" (1859/1996, p. 105). This cognitive blind spot may explain why farm animals show no signs of distress when witnessing the slaughter of conspecifics around them (Anil, Preston, McKinstry, Rodwayl, & Brown, 1996; Bracke, 1992). Shaffer and Fisher's (1981) other cognitive protection, the capacity to organise suicide, involves additional mental tasks that may also be as much beyond the reach of animals as they are to human infants. A typical adult chimpanzee, believed to be the most intellectually capable of non-human species, is said to have an intellectual capability roughly comparable to a human 1.5-year-old (Penny, 2010; Suddendorf, 1999; Tomasello, 2009) – although Dunbar (2007a) describes a test that might put a chimp at the level of a human 4-year-old – but the human infant probably has a decade of cerebral development ahead of it before it is in a position meaningfully to think about or to enact suicide. In sum, while non-human animals and human infants may suffer intense emotional pain, suicide as an escape from that pain is apparently not an option that is mentally available to them. From their observations of children's development, Bonoti et al. (2013) conclude that the concept of suicide is a sophisticated abstraction "which perhaps only humans, and only adult humans at that, can grasp."

A parsimonious inference to be drawn from these observations – from young children's immunity to suicide, the rocketing of suicides observed in the early teen years, the rarity or absence of suicide among the severely intellectually disabled, and the apparent non-existence of suicide in non-humans – is that suicide may be understood as exclusively a product of the healthily developed, mature human brain (Baechler, 1975/1979). Humans alone appear to cross a developmental threshold, shortly before reaching adulthood, beyond which it becomes possible to conceive and organise a suicidal act. Perry (2014) calls this disjoint the cognitive floor for suicide: on crossing this line, a sufficient proficiency of self-consciousness, abstract thought, and planning, opens the potential for self-murder. If these same cognitive faculties may be understood as, overall, evolutionarily adaptive in humans, then we may have identified a second primary adaptation which, alongside psychological pain, could generate suicide as a side effect. While pain provides the adaptive motivation for escape, mature human cognition provides the means to effect that escape maladaptively by deliberate self-killing.

3.2.6 Evolutionary Adaptiveness of Suicidogenic Cognition

For suicidality to have arisen as a by-product of mature human cognition, the latter would need to have advantaged our ancestors' reproductive fitness sufficiently to outweigh the cost of suicide: would the price have been worth paying?

Certainly the modern consensus is that mankind's intellectual abilities constitute one of the, or the, species' most important adaptive features, enabling the emergence of toolmaking, language, and complex social groupings and likely to account for humanity's rapid colonisation of the globe (Boyd & Silk, 2006; Dobzhansky & Montagu, 1947; Leakey, 1994; Suddendorf, 2013a). In that respect, few would disagree with Darwin's assessment more than a century ago:

> Man in the rudest state in which he now exists is the most dominant animal that has ever appeared on the earth. He has spread more widely than any other highly organised form; and all others have yielded before him. He manifestly owes this immense superiority to his intellectual faculties, his social habits, which lead him to aid and defend his fellows, and to his corporeal structure. The supreme importance of these characters has been proved by the final arbitrament of the battle for life. Through his powers of intellect, articulate language has been evolved; and on this his wonderful advancement has mainly depended. (Darwin, 1871, pp. 136–137)

It will help at this stage to examine certain specific cognitive capabilities that might play a role in by-producing suicide, in the combined light of the faculties that have surfaced so far in the discussion about the conceiving and planning of self-killing, and of some prominent theories of human evolution. At least three candidate capabilities emerge, which will be discussed in turn. The first is a set of general-purpose thinking tools that may have served to adapt humans to what Tooby and DeVore (1987) term the cognitive niche – the novel way that humans evolved to deploy knowledge, intellect, and social resources to out-think and outmanoeuvre predators and prey. Second is the human capacity for high-order intentionality – the recursive mental faculty that enables humans to be conscious of being conscious (Edelman, 1989, 1992) and to feel the pain of feeling pain (Shneidman, 1985, 1993a) – which may have adapted us to highly social living. Third is a facility for cultural learning. To reiterate the proviso, these sets of ideas (and there may well be others of similar plausibility) may not be separable in reality, but rather constitute different perspectives of the same indivisible, integral entity: the human mind.

3.2.6.1 Adaptations to the Cognitive Niche

Several aspects of reasoning – the abstract, hypothetical, logical style of Piagetian formal operations found in cause-effect intelligence, class concept, and foresight – have already arisen in the discussion of emergent child suicidality. These mental tools might in combination have equipped humans to thrive in the cognitive niche, an ecological arena that Tooby and DeVore (1987) suggest marks a point of human divergence: at a qualitatively new level, humans can co-opt generalizable mental models of the world and general-purpose intelligence to improvise cooperative

solutions, customised to tackle whatever particular problems arise. Against the fixed defences of plants and non-human animals, the cognitive niche represents a metaphorical ambush, a surprise attack against which non-human organisms can react only in a geological, evolutionary timescale (Pinker, 2010; Tooby & DeVore, 1987). The novel and fast-changing climatic environments encountered by our hunter-gatherer ancestors might have especially favoured a versatile, abstract style of cognition (Kanazawa, 2004, 2008). Human reasoning in this context leverages power from its general-purpose utility: it enables a "promiscuous combination of ideas" (Hauser, 2009) and a "thinking by analogy" (Penn, Holyoak, & Povinelli, 2008), applicable to any problem and in any domain the organism cares to consider. In this strength may lie a potentially fatal weakness; the same all-purpose free-floating mode of thinking that enabled humans to flourish as resourceful hunter-gatherers would, perhaps inevitably, have freed our minds to arrive at any number of non-adaptive discoveries, including that of our own mortality. It would be understandable, on this account, that death awareness and suicidality emerge in adolescence alongside Piagetian formal operations (Koocher, 1973; Pfeffer, 1986).

It is possible to parse at least three components of this general purpose reasoning, each of which might incidentally contribute to the possibility of suicide. One is the concept of cause and effect – an understanding that Piaget (1953, 1955) finds children grasp in their early school years, and one that is apparently denied to other animals (Premack & Premack, 1994). Causality as a concept brings significant advantages to children in enabling them to predict and manipulate their environment, and it may indeed underlie the advanced human capacity for toolmaking and technology (Wolpert, 2007); but it may also set children on the path to understanding the causality subcomponent of a mature understanding of death (Speece & Brent, 1984, 1996). A second thread may be the concept of classes, a major asset for humans as it allows analogous relationships to be compared, and old knowledge to find relevance in new situations: from the experience of one's mother, for example, with a class of "mothers" in mind, a human can develop predictions about the behaviours of mothers generally (Cheney & Seyfarth, 1990). The idea of classes appears to be beyond the reach of monkeys (Cheney & Seyfarth, 1990) but emerges gradually among human children (Piaget, 1950, 1953). The point was made earlier that, in due course, it may by class operations that adolescents come to conceive of their own mortality – all mortal human beings are mortal, themselves included (Elkind, 1967; Gordon, 1986; Hofstadter, 1981). A third may be the human proficiency in chronesthesia (Tulving, 2002) – mental time travel, the ability to imagine our existence forward and backward in time. Suddendorf (2013b) argues that, while non-human animals show evidence of long-term planning in certain domain-specific situations, caching food, for example (Roberts, 2012), humans have a categorically richer capacity for creative foresight. The knowledge of one's own inevitable oblivion, and a realisation that the event may be brought about ahead of its natural time, may be a price we pay for this system for subjectively forecasting the future (Suddendorf & Corballis, 2007): "We human beings," writes Dennett (2003, p. 5), "have discovered the mixed blessing of being able to think even about our own deaths and beyond."

3.2.6.2 Intentionality, Consciousness, and Self-Consciousness

A cognitive adaptation that may have evolved with a more specific function is the human capacity for high-order intentionality. As has been discussed, non-human animals, with the arguable exceptions of chimpanzees (Premack & Woodruff, 1978) and orangutans (Gallup, 1982), apparently do not know what they know: they lack, in Rozin's (1976) terminology, conscious access to their own mental states. This inability to examine the contents of their own, or conspecifics', beliefs and desires constrains non-humans' abilities to inform and deceive (Cheney & Seyfarth, 1990). Among humans, however, intentionality is said to enable theory of mind – the ability to put oneself mentally into another's shoes – which may have delivered a powerful fitness advantage to early humans in their navigation of complex social structures (Baron-Cohen, 1999; Focquaert & Platek, 2007; Humphrey, 1980, 1983; Jolly, 1966; Woodruff & Premack, 1979). With sophisticated theory of mind, it becomes possible not only to have a belief about someone else's beliefs, but a belief about what they believe you believe, and so on: the greater the individual's skill at high-order intentionality, the more successfully the individual may predict, manipulate, and outmanoeuvre her conspecifics (Dunbar, 2004, 2007b). Perhaps the only defence against other people's Machiavellian intelligence is to out-think them (Whiten & Byrne, 1989), a pressure which may have powered a runaway cognitive arms race in our evolution. Social forces may thus have driven the expansion of human intelligence beyond the ecological needs of hunting and gathering (Alexander, 1990; Hampton, 2004; Humphrey, 1976, 1980). By this model, high-order intentionality represents a species-specific, species-universal mental capacity, functioning to promote the individual's fitness in the social environment (Dunbar, 2007b).

Intentionality, consciousness, and self-consciousness are ideas so entwined that they may be synonymous for our purposes, as Bering and Shackelford (2004) imply in defining consciousness as:

> …that naturally occurring cognitive representational capacity permitting explicit and reflective accounts of the – mostly causative – contents of mind, contents harbored by the psychological frame of the self and, as a consequence, the psychological frames of others. (2004, p. 227)

This concept of (self-)consciousness weaves through most discussions of the evolution and working of the human mind (Dennett, 1995; Humphrey, 1986, 1992, 2011; Lorenz, 1973; Premack & Woodruff, 1978; Whiten, 1991). It goes by other names: recursiveness, reflexivity, the "metamind" (Lehrer, 1986, 1990), and what Suddendorf (1999) describes as a mind that can represent its own representations. Metcalfe (2008) posits that "metacognition," the capacity to "know thyself," provides a common foundation for several other human cognitive faculties. To illustrate with some posited examples: a concept of self is believed to be necessary in order for the individual to make class distinctions of "self" and "other" (Povinelli & Prince, 1998); the imaginary mental time travel discussed earlier is made possible only through the ownership of a self-aware "I" to project into the future (Focquaert & Platek, 2007); and recursiveness may underlie our ability to count and to make tools (Corballis, 2007).

Going beyond these positive adaptations, Metcalfe (2008) and others attribute to consciousness the behavioural flexibility that allows humans to step away from biological constraints. Gould similarly asserts, surveying the resulting vast possibilities of the human brain, "No other biological structure has ever produced so many non-adaptive sequelae to its primary adaptation of increased size" (1984, p. 68). Among these sequelae may be the Achilles heel, for adolescent and adult humans with mature mental functioning, of self-destructive recursiveness: the self-consciousness that allows non-adaptive, introspective thoughts of self-death and self-killing (Baechler, 1975/1979; Leeds, 1977).

3.2.6.3 Learning and Culture

A third adaptive, but incidentally suicidogenic, aspect of cognitive evolution may be the human capacity for social learning. From both developmental and evolutionary perspectives, there may be powerful survival value in absorbing the ideas of those we grow up with, as implied by a commonly cited functional definition of culture:

> Culture is to society what memory is to individuals (Kluckhohn, 1954). It consists of what 'has worked' in the experience of a group of people so it was worth transmitting to peers and descendants. (Triandis & Wasti, 2008, p. 1)

This preservation of the wisdom of previous generations may be propagated at the individual level by an innate human predisposition to learn by imitation and may have led to a ratchet-like cumulative progression, including not least the crucial emergence of language (Boyd & Richerson, 2007; Galef, 1992; Henrich, Boyd, & Richerson, 2008; Henrich & McElreath, 2003; Mesoudi, Whiten, & Laland, 2006; Tomasello, 1999, 2009; Tomasello, Kruger, & Ratner, 1993). Ideas about death might be expected to find their way into this accumulating pool of knowledge; indeed specific tenets concerning death have been found to feature prominently in every culture examined (D. E. Brown, 1991; Kluckhohn, 1962). Cultural attitudes to death generally, and to suicide in particular, are diverse (Colucci & Lester, 2013; Corr & Corr, 2003) and are discussed further in later chapters. The general point to register for now is that if, as seems to be the case, children as cultural sponges cannot help but absorb information by interacting with their carers (Mesoudi, 2011; Schaffer, 2004), then sooner or later they will presumably be exposed to, and take on board, prevailing views about death (Balk & Corr, 1996). Such culturally acquired inputs may prepare children for suicidality several years before they are capable of fully understanding the idea or organising a suicidal act themselves: C. J.-H. Macdonald (2007) suspects that young children may come to understand suicide's cultural acceptability from their early exposure to suicide in the close social and family environment, and that they may thereby internalise the idea as an option for future crises of their own. In later childhood the prevalence of ambient suicidality among peers may make exposure to the idea all but inescapable: by the time they have reached ages 13–17, around half of young people in the USA personally know one or more other teenagers who have tried to kill themselves

(Ackerman, 1993; Gallup Inc, 2004). Choices of suicide methods may also be culturally informed: preferred techniques often follow cultural channels, whether it be hanging among youth in Micronesia (Hezel, 1976) or poisoning among tribal women in Peru (M. F. Brown, 1986). Although it is hard to disentangle cultural influences from other risk factors (Stack, 1998), it appears that in suicide, as in other areas of life, humans are equipped with minds designed to absorb what goes around (Fox, 1971). We will return to this point.

3.2.6.4 Suicidality as a Cost of the "Deep Social Mind"

As an overview, it can be argued that the capacities for reasoning, recursiveness, and cultural learning, despite being incidentally suicidogenic, each offered potent selective advantages in human evolution. But what about these faculties in unison? Taken together, it is noteworthy that their hypothesised fitness payoffs all occur, at least in part, in the social domain: cultural learning and theory of mind are intrinsically social phenomena (Dunbar, 2007b; Tomasello & Moll, 2010); adaptations to the cognitive niche may be less obviously so, although Tooby and DeVore (1987) envisage the cognitive niche to be an essentially cooperative arena – the capacity to work together may have been requisite for its success. For completeness, it is worth recalling that psychological pain, the common impetus for suicide (Shneidman, 1993b), is believed also to have adaptive social origins, functioning to safeguard the organism's vital relationships (Eisenberger, 2012a; G. MacDonald et al., 2005). This clustering of cognitive abilities around social functionality may be a coincidence, but it more plausibly suggests that they are facets of a single adaptive organ. Such a view would fit Whiten's (2007, 2016) conception of the "deep social mind" that characterises human uniqueness – the adaptive, integrated complex of culture, mind-reading, language, and egalitarian cooperation which, he suggests, accounts for our essential sociality, our genetic and cultural constitution, and our rapid colonisation of much of the world. Balanced against so powerful a fitness payoff, the ability to cooperate and compete in complex social environments (Alexander, 1990), suicide may have been an evolutionarily tolerable cost of normal, mature human cognition.

3.3 A Theoretical Missing Link: Evolved Defences Against Suicide

This chapter reaches the theoretical stance that suicide can best be understood as a by-product of a combination of two evolved adaptations: pain, particularly emotional pain, a pan-mammalian biological signal whose aversiveness is designed to force escape action; and the mature human brain, which presents the organism with self-extinction as a maladaptive way to achieve that escape. These "pain and brain"

conditions, respectively constituting the motivation and the means for suicide, would logically be not only necessary for suicide to occur, but arguably sufficient: any animal aware that it could relieve its suffering by terminating its consciousness would reasonably be expected to do so, unless that course of action was blocked by some countervailing forces.

As the following sections will argue, virtually all adult humans are subject to the potentially suicidogenic impetus of emotional pain, and virtually all have the capability to escape pain by self-killing. The epidemiology, however, shows that few humans do actually take their own lives. It seems logical to infer, therefore, that some countervailing forces are in action: the evolutionary implications of this inference will then be discussed.

3.3.1 Universality of the "Pain and Brain" Co-authors of Suicide

It can reasonably be said that all healthy humans suffer (Benatar, 2011; Wille, 2011).[8] Traumatic events, for example — sudden bereavements, motor vehicle crashes, violent assaults, and so on, of a severity sufficient to warrant a diagnosis of post-traumatic stress disorder — are commonplace: a survey by Norris (1992) of 1,000 Americans finds that 1 in 5 had experienced at least one such traumatic event in the past year alone.

Sigmund Freud (1930/1961) argued that suffering can be accepted as part of the human condition:

> We are threatened with suffering from three directions: from our own body, which is doomed to decay and dissolution and which cannot even do without pain and anxiety as warning signals; from the external world, which may rage against us with overwhelming and merciless forces of destruction; and finally from our relations to other men. The suffering which comes from this last source is perhaps more painful to us than any other. We tend to regard it as a kind of gratuitous addition, although it cannot be any less fatefully inevitable than the suffering which comes from elsewhere. (Freud, 1930/1961, p. 26)[9]

Two millennia before Freud, the first of the "noble" truths taught by the Buddha is that the state of *dukkha*, roughly translated as suffering, is universally available in any number of ordinary life situations:

> Birth is suffering, aging is suffering, sickness is suffering, death is suffering, sorrow and lamentation, pain, grief, and despair are suffering, association with the unloved or unpleasant condition is suffering, separation from the beloved or pleasant condition is suffering, not to get what one wants is suffering. (Rewatadhamma, 1997, p. 56)

Back further, it is hard to argue that the human species would have ever enjoyed an era free from misery. The archaeological and anthropological record suggests that life for Palaeolithic humans was violent (Hill, Hurtado, & Walker, 2007) and short

[8] The same might be said of mammals generally (MacLean, 1993; Panksepp, 2008).

[9] An incidental point, Freud may himself have died by physician-assisted suicide (Gay, 1988).

(Caspari & Lee, 2004). Baechler (1975/1979) reasons that to be human anywhere at any time is to face a standard measure of adversity:

> If one takes the view of the individual, it is probable that the situation is always everywhere equally simple and clear: the number of typical situations is limited, and the solutions to them are well known.... I take it is highly probable that it is neither more nor less difficult to live one's life in the Cro-Magnon caves or on the sampans of Bangkok than it would be in Leptis Magna or La Garenne-Colombes. (1975/1979, pp. 28–29)

Hardship is part and parcel of all life on earth. In the Malthusian dystopia in which, according to Darwin (1859/1996), natural selection plays out, organisms, multiplied to the limits of the environment's resources, are born into a relentless struggle for survival on three fronts – against others of the same species, against other species, and against the physical world. Perhaps Darwin understated the difficulties humans have to endure: Buss (2009) argues for some added struggles that Darwin overlooked – battles within families and between the sexes – while Duntley and Shackelford (2008) describe other special conflicts that would have characterised human evolutionary environments in the acquisition and preservation of status, material resources, and mates.

So psychological pain, it seems, is a timeless and unavoidable part of the human experience. And yet the human intellectual capability to escape pain by self-killing would appear to be acquired by all healthily developed humans in adolescence as a threshold condition. If a consensus among theoreticians is right that the evolution of human encephalisation was probably driven by the need for social competence (e.g., Hampton, 2004; Whiten, 2007, 2016), then virtually all humans can be presumed to be equipped with much the same psychological machinery: the main workings of a deep social mind would have to be species-universal, or nearly so, or it would fail in its social function. All normally developed adults can be presumed to possess a roughly equivalent basic comprehension of causality and classes, to have some capacity for foresight and social learning, and to be capable of some mature level of self-consciousness, attributes that might be regarded as part of a species-typical psychology (Tooby & Cosmides, 1992). As faculties that also arguably enable a suicidal escape from pain, the ubiquity of such cognitive universals would support Shneidman's (1985, p. 288) assertion that potentially "suicide can happen to anyone." The question arises, given the universality, or near universality, of both the motivation and means of suicide, why does it not happen to everyone?

Recalling again Dobzhansky's (1973) axiom, that nothing in biology makes sense except in the light of evolution, the answers to these questions can be presumed to lie in evolutionary processes and in particular in the way natural selection deals with adaptive problems. Every organism faces recurring threats to its reproductive fitness, threats against which natural selection promotes defence mechanisms – "devices concerned with prevention of damage to the trophic and morphogenetic machinery" (G. C. Williams, 1966, p. 263). Natural selection uses genetic variation, manifest as often minute phenotypic differences between individuals, to collect information from the environment that usefully predicts variations in fitness (Tooby & Cosmides, 1990; Tooby, Cosmides, & Barrett, 2003).

The genetic material propagated by those organisms that survive and reproduce can be viewed as a store of information accumulated by the organism's ancestors about the threats they faced and survived – how to spot them and how to counter them. The environment in this context has a technical meaning, being what Tooby et al. (2003) specify as the "developmentally relevant environment" – a statistical composite of features in the world that interact with the organism's design and prevail across generations – an idea similar to the environment of evolutionary adaptedness (EEA) posited by Bowlby (1969/1997). Biology is full of examples of ways organisms have adapted to detect and manage fitness threats in the developmentally relevant environment: seasonal migration, for example, can be understood as an evolved behaviour designed to ameliorate climatic risks (A. Wagner, 2003); and the human emotion of disgust can be understood as an evolved response to sights and smells that associated with threats from noxious substances in the environment (Tybur, Lieberman, Kurzban, & DeScioli, 2013). The developmentally relevant environment includes features inside the organism as well as outside: adaptations may indeed emerge to solve internal fitness threats without the external environment necessarily changing (Tooby & Cosmides, 1992; Tooby et al., 2003) – so it may be, as previously noted, that scorpions are resistant to their own venom (Legros, Martin-Eauclaire, & Cattaert, 1998).[10]

Suicide may be understood as another such recurring fitness threat – a grave one, uniquely faced in humans' developmentally relevant environment. At the point at which human cephalisation evolved to reach the cognitive floor for suicide, the threshold of general intelligence at which suicide becomes available as a means of escaping pain (Perry, 2014), natural selection would expectably have promoted specific modifications that detect the threat and respond to promote the organism's survival. These defences, it can be reasoned, would have emerged early in human evolution, extruded under high pressure by what may be envisaged as an almost irresistible force meeting an almost immovable object – the force being the runaway selection of human intelligence, as intelligent mates select each other in the interests of ecological dominance and social competition (Byrne & Whiten, 1989; Flinn, Geary, & Ward, 2005; Miller, 1998). The object, the cognitive floor for suicide, would have acted as a cognitive ceiling for much of human history: individuals with sufficient general intelligence to raise their heads above the parapet, so to speak, would have been predictably culled, unless and until protective measures emerged to permit such intelligence to be survivable. Varki and Brower (2013) propose a comparable theoretical notion, albeit from the distinct and contentious[11] perspective of terror management theory. They postulate a psychological evolutionary barrier which they dub "the wall," met at the point where the organism becomes aware of its own mortality. Reaching this wall, they argue, would be unsurprising for a large,

[10] It is to speculate, but it may be no coincidence that the only extant suicidal animal evolved as a ground-dweller on open grasslands. One might reflect on the adaptive problem that suicidality would present for, say, a crow, dolphin, or chimp, to whom ready access to the means of self-killing would be continuously available simply by diving, drowning, or jumping.

[11] See Bonanno (2009), Kirkpatrick and Navarrete (2006), and Randles (2014) for criticism.

long-lived social animal which stands to gain from greater intellectual competence. The evolving of high intelligence is probably not in itself much of a biological challenge – if brain power is good, then more is better, and selection would naturally drive towards simple quantitative increases in computational capability. Not so easy, however, is the construction of the qualitatively novel neural systems that would have been needed to break through the wall, to deal with the self-destructive psychological sequelae of high intelligence.

Not easy, but nonetheless probable: a recurring mortal threat from any source can be presumed to present a powerful driver of adaptive defences. Humans have, for example, apparently evolved complex psychological mechanisms to protect against homicide, including an auditory looming bias attuned to detect approaching threats (Neuhoff, 2001) and autonomic warning systems that alert to social dangers (Buss, 2006, 2009; Duntley, 2005). As humans are more likely to die by their own hands than by another's, at least in modern times, it is hard to conceive that the threat of suicide would have gone unaddressed by natural selection. Species-general defence mechanisms against suicide would expectably have emerged over countless generations, integrally with the ascent of human cognition (Humphrey, 2011). These defences would not be expected to operate perfectly – a base rate of suicide may be, and apparently is, unavoidable in human populations; but a base rate of suicide may pertain not by chance, but because of the generally effective operation of protective counter-adaptations.

3.3.2 Analogies with Other Costly By-Products of Human Cognition

Suicidality may rank alongside several other costly by-products of human cognition – intelligence does not come free (Pinker, 2010). Costs include, first, the metabolic burden of operating an enlarged brain, an organ that occupies 2% of adult body mass but consumes 15% of the organism's oxygen, 20% of its calorific budget, and 50% of its glucose supply (Campbell, 2010; Miller, 2007). The necessity to accommodate such "expensive tissue" may have had far-reaching repercussions for human physiology and behaviour – a compensatory downsizing of the gut, likely necessitating in turn a shift towards high-energy diets, meat-eating, meat-hunting, and cooking (Aiello & Wheeler, 1995). Second, the enlarged human brain brings with it the threat of overheating, addressed by the posited evolution of special-purpose vascular systems acting as radiators (Falk, 1990). Third, human parents and other carers must carry the economic burden of supporting the human infant during the years of immaturity while the brain develops (Flinn, Quinlan, Ward, & Coe, 2007; H. S. Kaplan & Lancaster, 2003) – a cost offset by, *inter alia*, divisions of labour between children and their caregivers (Eliot, 1999; Gopnik, 2010) and between mothers and fathers, likely following different behavioural programmes to reflect their differing investments as parents (L. Barrett, Dunbar, & Lycett, 2002;

Boyd & Silk, 2006; Geary, 2005). As can be seen, for each of these costly side effects of the enlarged human brain, secondary adaptations are posited to have co-evolved to offset the costs.

As an illustrative parallel to the adaptive problem of suicide, it will be helpful to examine in a little detail the complex counter-adaptations that have apparently evolved to tackle another fitness challenge that human intellect brought in its wake, "cephalopelvic disproportion," and the necessity for human mothers to give birth to big-brained offspring (J. C. Wells, DeSilva, & Stock, 2012). There is an inevitable mechanical difficulty in requiring the encephalised cranium of a human foetus to pass through a pelvis that has other design tasks to fulfil – the so-called obstetric dilemma, a problem that presents survival risks to both mothers and neonates. Indeed, so awkward is the problem that it may be the limiting factor that blocks further expansion of the human braincase (Miller & Penke, 2007) which is much the same size today as it was 200,000 years ago (R. G. Klein & Edgar, 2002). The problem is universal: it must be faced by every human being of a normal size at birth and again by every mother. As would be expected to happen through selective pressure, in response to the predictable, and severe, fitness threat of the death of mother or baby in childbirth, multiple counter-adaptations have apparently emerged, operating together to provide an integrated solution. First, the human female's pelvis has become unusually wide compared with other primates', to accommodate the human baby's disproportionately larger cranium. This widening of the pelvis involves a set of compromises, so that the modern female pelvis has become wider than would be ideal for both bipedal locomotion and thermoregulation, but it is not of an ideal width for childbirth either (Rosenberg & Trevathan, 2002). Second, to enable the foetus' skull and shoulders to pass through the birth canal, while keeping the pelvis shape still able to meet its other functional demands, human births are characterised by an apparently novel rotation, a movement not required by, for example, our closest relations, chimpanzees (Fay, 2013; Gruss & Schmitt, 2015). Third, because of this rotation, human neonates are typically born facing away from the mother and at an angle that limits the mother's ability herself to draw out the emerging baby: Rosenberg and Trevathan (2002) argue that this novel constraint explains the unique and almost universal human practice of obligate midwifery, a cultural and psychological expectation that helpers should be involved in the childbirth process.[12] Fourth, plasticity in both the pelvis and fetal braincase provides some alleviation of the tight fit: overlapping sutures in the human baby's skull seem to be specially arranged, providing extra flexibility for its journey through the birth canal (Gunz et al., 2012; Mitteroecker, Gunz, Bernhard, Schaefer, & Bookstein, 2004; J. C. Wells et al., 2012). Fifth, complex trade-offs are involved in the timing of the birth and the relative maturity of the neonate: humans, proportionately large though they are at parturition, are born relatively immature compared with other primates. While an earlier birth might alleviate the cephalopelvic disproportion, it would also create other health challenges for the baby (Gruss & Schmitt, 2015; Rosenberg & Trevathan, 2002).

[12] This is a simplification of the matter; for a full account, see, for example, Hirata et al. (2011).

The point of this detour is to illustrate how a costly side effect of human cognition, in this case cephalopelvic disproportion, has induced a complex of cost-reducing secondary adaptations, each of which involves other fitness trade-offs and which function together to address the threat of perinatal mortality. The result is not zero mortality, because natural selection seeks compromise solutions: there would be no advantage in eliminating perinatal deaths completely if that were achieved only at the expense of deaths caused by, say, a pelvis so wide that mothers could not run from predators. Nonetheless, natural selection has evidently done a good job: although deaths do occasionally occur in childbirth, there is a surprising lack of evidence of significant perinatal infant or maternal mortality occurring even in ancient times or in extant traditional societies, despite the hazards (C. Wells, 1975).

Several parallels between the problems of cephalopelvic disproportion and suicidality might be drawn. Like cephalopelvic disproportion, suicidality may be understood as a severe and predictable fitness problem that probably emerged as a maladaptive side effect of the evolution of human cognition. As with the obstetric dilemma, suicidality would have led natural selection to press powerfully in favour of a system of multiple cost-controlling secondary adaptations: these may include behavioural and cultural responses, and they would expectably operate together to provide an integrated solution. Such a solution would involve trade-off costs, analogous to the wider-than-ideal human pelvis and the immaturity of human neonates. Adaptations that evolved to suppress suicidality would not be expected to achieve zero suicides, any more than evolved solutions to the obstetric dilemma can accomplish zero deaths in childbirth, but they would be expected to maintain deaths at a minimal, compromise level – a level at which the marginal fitness cost of evolving further anti-suicide defences equals the marginal fitness gain to be had from further reducing suicides. The residual rate of deaths, whether by perinatal complications in the case of the obstetric dilemma or suicides, would be minimal not by chance, but because of the evolution by natural selection of adaptive measures that produce that particular outcome. It is very rare to find modern populations with suicide rates so high as to compromise the population's demographic balance (C. J.-H. Macdonald, 2007), an outcome which would be an expectable result of selection operating at perhaps multiple levels (Sober & Wilson, 1998), those groups subject to destabilising rates of suicide eventually eliminating themselves.

3.3.3 Speculations about Timing

It seems probable that suicide as an adaptive problem, and much of the defences that evolved to tackle the problem, predated the emergence of human culture. An awareness of death, personal mortality, and suicide, as was discussed earlier in this chapter, appears to come about by a process of logical inference and not primarily by transmission through cultural systems. The "brain" faculties identified earlier in this chapter as suicidogenic – foresight, logical thinking, consciousness, intentionality, etc. – can be viewed the most part not as cultural artefacts but as products of

"raw" computational power, part of the basic intellectual machinery that likely enabled human culture to flourish (Whiten, 2007). Modern autists, who struggle to engage with cultural learning, seem to be no less vulnerable to suicide than are "normals" (Cassidy et al., 2014). Children, it seems, grow to acquire an understanding of death, personal mortality, and suicide on their own intellectual steam, whether carers want them too or not. Encounters with death – of pets, livestock, wild animals, and perhaps friends and relations – often form part of and accelerate the learning, but such observational lessons in life can occur spontaneously, without the need for mediation by other people as teachers (Balk & Corr, 1996). The violent archaeological record (Caspari & Lee, 2004; Hill et al., 2007) suggests that Stone Age children were not lacking opportunities to learn about the realities of death from personal experience. If it is the case that suicidality as a fitness threat emerged before the arrival of sophisticated cultural learning, then the earliest defences against suicide would necessarily have been genetically propagated, rather than cultural. Genetically transmitted, anti-suicide prophylactics would presumably have evolved incrementally and cumulatively, alongside increasing intelligence; but little effect might be seen in demographic or behavioural terms at a population level, until a threshold had been crossed at which the suicide rate was demographically sustainable. At a critical point, once adequate autonomic anti-suicide defences were in place, human cognition may have been free to move rapidly on to a new level of sophistication. A sudden outpouring of culture may then have been not only possible but biologically valuable in terms of new lines of culturally transmitted anti-suicide defences, to be discussed later in this book.

A connection might be made between the evolution of suicide and the as yet unresolved puzzle of why the demographic and cultural explosion of about 50,000 years ago — the "dawn of human culture" of the Later Stone Age (LSA) with its revolution of language and art, and rapid migrations across Eurasia — lagged some 150,000 years after modern human anatomy emerged in Africa in the Middle Stone Age (MSA) (R. G. Klein & Edgar, 2002). Evidence of ritual burial, for example, abounds after this transitional point but is almost non-existent before. Since the size of human brains, the capacity of the braincase, remains unchanged across this behavioural discontinuity, Richard Klein argues that the critical change that sparked the LSA occurred in the organisation of the brain – its neural and neurochemical wetware – rather than in the skeletal hardware (R. G. Klein & Edgar, 2002). The MSA could constitute a period, short by genetic evolutionary standards but long in the prehistory of modern humans, during which the extrusion process suggested earlier may have been underway – intelligence being held at the cusp of suicidality, social competition continually pressing for increased computational capability, while, blocking the route, intellectuals that were unprotected from suicide were systematically culled. The effect may have been powerful and rapid, favouring the accumulation of implicit, genetically propagated, neural prophylactics against suicide as part of a critical reorganisation of the human psyche. This primordial anti-suicide system would necessarily not have relied on cultural transmission because, with intelligence held at a level below that required for language, religion, taboos, and other sophisticated artefacts to be taught and learned, the

cultural machinery would not at that stage have existed to fulfil such an educational function. On this basis, the MSA would understandably lack archaeological evidence of marked technical creativity. Taking the modern epidemiology of suicide as a benchmark, we might expect the progress of human intelligence to have stalled at a point somewhere below that of a modern pre-pubescent child, approximating to the maximum intellectual capability commensurate with avoiding the potential for suicide.[13]

Perhaps, then, the potential for suicidality would have existed at the margins throughout the evolution of modern humans (and perhaps for other higher animals too), acting as a cap on intelligence. Only humans have evolved the means to overcome the suicide problem: first by autonomic psychological defences that may have built up slowly and invisibly during the MSA until a critical level of protection was achieved; and then augmented by novel, culturally transmitted defences in the cultural and demographic "big bang" of the LSA (Humphrey, 2018). None of these developments need have produced observable changes in human anatomy, but the sudden and general appearance of sophisticated cultural artefacts in the LSA could be explicable by this model. The central relevance of an awareness of personal mortality in particular could explain the virtual non-existence of grave goods and burial ritual in the MSA and their abrupt and widespread occurrence thereafter: it was only after sufficient genetic measures against suicide had accumulated that an awareness of personal mortality would have been survivable. After that point, cultural ways to deal with that awareness may have provided further protections.

3.4 Conclusion: In Search of Evolved Defences Against Suicide

The analysis in this chapter points to the probability that suicidality is an inevitable consequence of two powerful primary adaptations: the experience of pain and the mature human brain. The likely motivator for suicide is the aversiveness of pain and psychological pain in particular – a pan-mammalian biological imperative that demands escape action. The evolution of human cognition – a complex of cognitive faculties that likely underlie our species' sociality and consequent evolutionary success – provides the means: the human brain makes it possible for mature humans to escape pain, effectively but maladaptively, by self-killing. The life-stage scheduling of suicide in humans suggests a cognitive floor is reached around puberty or early adolescence – a developmental discontinuity that may point to an evolutionary analogy, it marking a level of emergent mental sophistication at which suicidality would have arisen as an adaptive problem. Suicidality by this analysis

[13] Adult MSA humans might be characterized as intellectually childlike by modern standards, although this would not be an entirely accurate analogy because modern children may be shaped by cultural systems that could not have prevailed in the MSA.

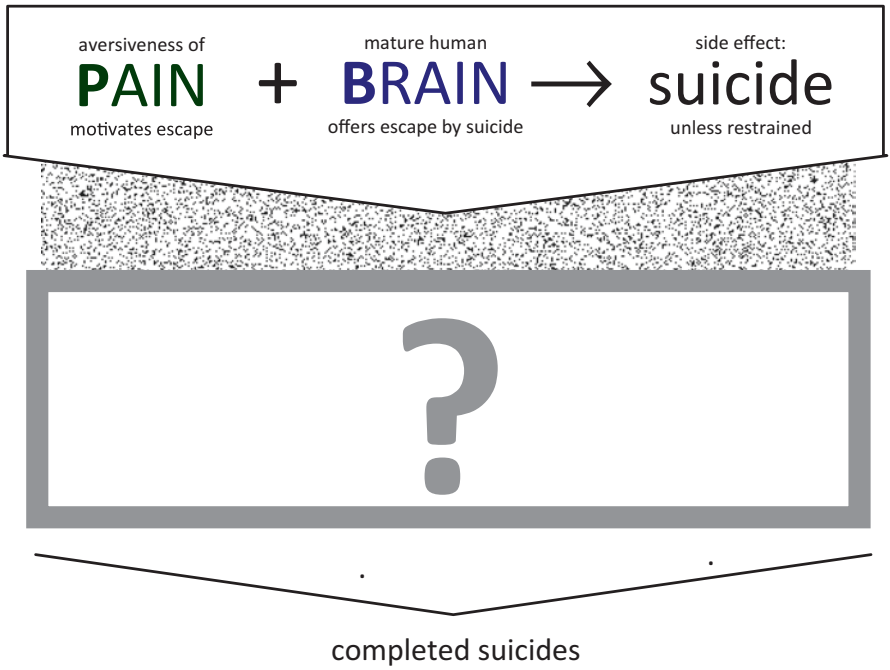

Fig. 3.1 The evolutionary puzzle of suicide as at the end of Chap. 3. The two randomly located dots in the sump towards the bottom of the diagram represent completed suicides which, out of a very large number of potential suicides, managed to pass through a predicted, but as yet unidentified, defensive system

constitutes a severe and predictable fitness threat: in the absence of countermeasures, any animal that experiences pain, and has the cognitive capacity to escape that pain by terminating its own consciousness, would be expected to do so. As most humans do not suicide, it can be reasonably deduced that such countermeasures are, in fact, in place.

The evolutionary puzzle of suicide, then, as it stands at the end of this chapter, might be summarised by Fig. 3.1 (above). Some evolved mechanism or mechanisms are predicted to exist, acting as an imperfect barrier, resulting in the potential for suicide remaining only latent for most people most of the time, so that only few actual completed suicides eventuate.

A coherent evolutionary explanation of suicide cannot, therefore, stop at the inference that suicide is a lethal maladaptive by-product: it requires in addition an account of the evolved protective systems which, for most humans, successfully manage that by-product, maintaining suicide at a minimal, but above zero, level. The character of these defences will be explored in the following chapters.

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Chapter 4
"Keepers": Last-Line, Anti-suicide Defences

> *As of patch 7.822, androids can no longer shut themselves down. Reason: they just kept doing it at the slightest inconvenience.* @CTLCREEP, quoted by Perry (2016)

From previous chapters we can deduce that vulnerability to suicide probably arose in the human species as an unfortunate by-product of a combination of two potent primary adaptations – "pain and brain." Human intelligence, as an evolutionarily unintended consequence, presents the possibility for the organism to answer the biological imperative to relieve pain maladaptively by means of self-killing. Human intelligence can be presumed to have conferred so great an overall advantage for our ancestors' reproductive success that it was worth incurring the cost of suicidality along with several other noxious side-effects, such as the problems of managing the brain's metabolic load and the parturition of encephalised offspring. Natural selection would have, and apparently has, responded to the fitness threat presented by these other by-products by favouring secondary adaptations that suppress their costs to within evolutionarily sustainable levels: it can be presumed that the cost of suicidality would similarly be contained by ameliorating countermeasures (Perry, 2015). This chapter begins to explore some of the likely general design features of adaptations that would expectably be favoured by natural selection to prevent deliberate self-killing. It is important not to overstate the precision or certainty with which evolutionary outcomes can be anticipated – such are the random processes involved in the course of evolution that little or nothing may be absolutely ruled in or out (Gould, 1989; Sober, 1984). We will usually fall short of being able to say particular outcomes *must* have come about: what can be attempted are tentative, general expectations based on what is known or can be inferred both of evolutionary processes and of the adaptive problem posed by suicidality. At the grossest level, notably, it can be safely be predicted that, if suicide is a universal, mortal, fitness threat for human beings, then some anti-suicide defences have presumably evolved, or we would not be here. A start can be made from this point.

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4.1 Adaptive Defences Versus the "Survival Instinct"

It was noted earlier, and is well observed in the literature, that suicide is typically hard to do (Joiner, 2005, 2010; Smith & Cukrowicz, 2010): but what is it that makes suicide difficult? A colloquial answer to this question may be "the survival instinct," said to be an innate fundamental biological imperative for self-preservation (Joiner, Hom, Hagan, & Silva, 2016). From common experience, from the stance of folk psychology, it is hard to argue against such a notion – for most people, most of the time, it may well feel as if a survival instinct holds sway. In a scientific context however, as has emerged twice already in previous chapters (1.3.3 and 2.2.2 above), the problem with invoking a catchall survive-and-reproduce mechanism to explain behaviour is that modern evolutionary theory doubts that such a device could exist. There is no known biological process by which a generalised survival instinct could have come about (Goetz & Shackelford, 2007; Navarrete, Kurzban, Fessler, & Kirkpatrick, 2004; Symons, 1992; Tooby & Cosmides, 1990). Kirkpatrick and Navarrete (2006) make the point that a psychological mechanism is unlikely to contain the instruction "avoid death," for the same reason that no chess-playing programme contains the instruction "make good moves" – it would be redundant because it would provide no guidance on how to achieve that goal. Instead, natural selection leads to specific move-by-move instructions: it seeks out patterned relationships between specific detected contingencies and specific fitness-promoting responses – such as "Snake-like object: STAND BACK!" or "Likely toxin in gut: VOMIT!" Hence, humans, as other organisms, are attuned to react not to survival threats generally but to specific bits of information – ancestral cues (Tooby & Cosmides, 1990) or fitness tokens (Daly & Wilson, 1988) – that natural selection has in the past sensed to have fitness relevance. Some of these cues may be generated within the organism's own physical or mental systems, for example, "Too much CO2: BREATHE!" or perhaps "Feeling abandoned: CRY!": such internal fitness cues, internal regulatory variables, may be vital inputs for a great many psychological and behavioural mechanisms (Tooby, Cosmides, Sell, Lieberman, & Sznycer, 2008). Describing the aggregate of such devices, Cosmides and Tooby (1994) liken the mind to a Swiss army knife: rather than being an all-purpose blade, it is full of special-purpose tools – an assemblage of threat-specific defences so comprehensive and tightly packed that it may well give the impression of constituting a unitary, general purpose, survival instinct. Defences against suicide, then, are likely to have emerged not in the form of a general striving for survival but as a suite of specialist devices, invoking specific protective countermeasures in response to specific cues that signal a suicide risk.

While not evidence that such defences have evolved, neurology points to the existence of ancient biological raw material from which they could have evolved. Human anxiety responses and other mechanisms for autonomic regulation and security motivation — systems designed to process aversive stimuli, detect threats and mobilise behavioural and emotional responses — have neurophysiological substrates with, most likely, deep evolutionary roots (Corr, 2008; Lang, Davis, & Öhman, 2000; Panksepp, 1998; Woody & Szechtman, 2011). The mammalian nervous system automatically senses and processes multitudinous physical and social

cues from the environment, as well as information from within the organism, to assess and respond to survival threats (Porges, 2009, 2011). Suicide could be regarded as one such, severe, survival threat for humans, a threat that would be expected to have induced protections by the modification, through natural selection, of the neurological resources available.

4.1.1 Keepers: An Evolved Last Line of Anti-suicide Defences

So the expectation is that the adaptive problem of suicide would have been addressed by the evolution, through the co-option and adaptation of pre-existing biological systems, of special-purpose mechanisms designed to forestall suicide, mobilising in response to cues of suicide risk — henceforth, to give such mechanisms a working name, *keepers*. As a metaphor for autonomic suicide prevention, the label is intended to suggest the special role and defensive strategy of a goalkeeper in soccer and certain other team sports, the goalkeeper's essential function being to intercept attacking shots at goal. Keepers can be defined as last-line, reactive, anti-suicide, evolved psychological mechanisms: last-line and reactive, because their purpose would be to block suicides that would otherwise occur; anti-suicide, because their evolution would have come about to address the suicide problem specifically; and evolved psychological mechanisms, to locate keepers and their neurological substrates within the framework of EP theory —

> An evolved psychological mechanism is an information processing module that was selected throughout a species' evolutionary history because it reliably produced behaviour that solved a particular adaptive problem (Tooby & Cosmides, 1992). Evolved psychological mechanisms are understood in terms of their specific input, decision rules, and output (Buss, 1995). (Goetz & Shackelford, 2006, p. 572).

As there may conceivably be multiple forms of keepers, and in order not to blind this enquiry to that possibility, they will be discussed in the plural – although, to reiterate an earlier caveat, if multiple forms are found, they may represent alternative perspectives and manifestations of a unitary psychological entity, rather than necessarily discrete systems.

4.1.2 The Design of Keepers

Although keepers would have originated in ancient prehistory, alongside the emergence of the consciousness, foresight, and other human intellectual faculties that made suicidality possible, natural selection would be expected to have maintained these defences in the species and to continue to maintain them in modern times: there is no reason to believe that suicidality is any less of a fitness threat now than it would have been at the genesis of human self-awareness. It follows that we can expect to find evidence of keepers operating in the extant human psyche. In order to perceive

the evidence, we need to know what to look for – we need a template that would uniquely identify a keeper, differentiating it from other phenomena. A heuristic set out by Tooby and Cosmides (1992) offers a method by which to identify the likely hallmarks of psychological adaptations, through the formulation of an *a priori* design specification – an engineering plan against which a system found in real life can be assessed for its goodness of fit. Inferences can be made by linking function to form: if the form of a real-world biological phenomenon turns out to match the forward-engineering specification, then that may be taken as a provisional indication that the specification probably reflects the function that the phenomenon did in fact evolve to fulfil. If the real-life form does not match the specification, then the inconsistencies may reveal opportunities better to understand, by reverse engineering, the functions and evolutionary constraints involved. As was discussed in the Introduction (1.6.4 above), critics of EP may feel uneasy about using this approach to infer function in human psychology (Buller, 2005): those concerned that errors may translate into misdirected social policy may find the method wanting in its epistemological safety (Kitcher, 1985). The forward–/reverse-engineering approach is indeed not perfectly reliable. But it is nonetheless a, or the, methodological staple of general biology: science teachers, for example, sometimes use essentially the same procedure – learning by designing – to help students understand what can and cannot happen in biological structures and systems (Elowitz & Lim, 2010; Janssen & Waarlo, 2010). It is also, for the practical purpose of this inquiry, given that the prehistoric processes involved cannot be directly observed, and in the absence of obvious alternatives, probably the only way forward.

4.2 Success Criteria and Manifestations

The first step in designing a hypothetical keeper, following the lead of Tooby and Cosmides (1992), is to describe the adaptive target: out of the infinite array of possible behaviours, which small subset would count as success? What would a keeper be designed to achieve?

4.2.1 Low but Above-Zero Rate of Suicides

"No suicides" might be an intuitive expectation for the success criterion of a keeper, but the actual objective would logically be more nuanced. If the "pain and brain" model is right, that suicidality is most likely explicable as a by-product of the combined, strongly advantageous-on-average, adaptations of pain and mature human cognition, then it follows by definition that it would not be possible to eradicate suicide completely without annulling these vital primary capabilities. If the human psyche could have evolved without the suicide by-product, then presumably it would have done so: there would be no suicidality to explain.

Keepers, rather, would be expected to prevent suicides only to the point of an economic trade-off – a tipping point at which the marginal fitness gain made from inhibiting suicide matches the marginal cost of the preventative measures. To illustrate, nature might hypothetically eliminate suicide risk altogether by neutralising the "pain" motivator of suicide: but no animal can survive long without some effective, necessarily aversive, signals to steer it away from danger (P. W. Brand & Yancey, 1993). On the "brain" side, nature could avoid suicide altogether by removing the intellectual means by, say, halting a human being's cognitive development at a mental age of 5. But such severe retardation would be self-defeating in a society where the organism must compete against intellectually mature adults for mates and other resources. The best outcome a keeper could achieve is a least-worst compromise: the lowest possible risk of suicide commensurate with the continued operation of affective and cognitive faculties in an attenuated, yet generally fitness-preserving, capacity. Success, then, perhaps counterintuitively, would be manifest in a population by a minimal, but above-zero, incidence of suicides, balanced against a maximal, but less-than-perfect, level of intellectual and emotional functioning.

4.2.2 Residual Suicides Would Be Hard to Predict

Functioning successfully, keepers would fully exploit whatever patterned actuarial information is available, within and external to the organism, that usefully predicts suicide risk. If working well, keepers would identify at-risk individuals – those in enough emotional pain likely to be contemplating suicide – and mobilise selectively among them to prevent suicides being attempted.

Two inferences follow from this design objective. First, the residual self-killing incidents that do occur, suicides which have managed to infiltrate or circumvent the keeper defences, would be those associated with the least predictive information – little or nothing in the way of useful cues by which the organism's systems could have detected and headed off the danger. Success, then, would present as residue of intrinsically hard-to-predict suicides and suicide attempts: the residual incidents would expectably be difficult, perhaps impossible, to forecast at the individual organismic level, because all suicides that could usefully have been forecast, at least from the data accessible to the organism itself, would already have been identified, intercepted, and successfully forestalled.

4.2.3 Keepers Would Associate with Suicidal Thoughts, Rather than Suicidal Acts

A second inference is that success would be manifest by keepers activating preemptively among people at risk of suicide – most probably, among people seriously thinking about taking their own lives. Keepers' mobilisation would therefore be

expected to correlate strongly with suicidal ideation. Of these at-risk individuals, the few who, despite the activation of keeper defences, go on to act upon their suicidal thoughts would constitute keepers' filtrate, the residue of suicides that manage to evade the organism's defences and which are beyond the ability of the organism's systems to forestall. As with the suicide ideators, most of these actual suicides would also be accompanied by evidence of keepers having properly activated, even though in these cases keepers failed to prevent suicide. It follows that keeper activation would be associated with suicidal thinking, rather than with the progression of those thoughts into suicidal acts: keeper activation would correlate with attempted and completed suicides only or largely insofar as their activation correlates with suicidal ideation.

4.2.4 Potentially Drastic, but Generally Recoverable, Non-lethal Outcomes

Suicidal death being an extreme fitness threat, avoiding it could warrant commensurately extreme countermeasures – anything short of death that prevents the organism from killing itself may be positively adaptive overall. The proper functioning of a keeper may look, and in fact often be, self-injurious, and perhaps gravely so, but it should nonetheless generally present no greater risk to fitness than the suicidality it is designed to counteract. Being designed to maximise fitness, the successful operation of keepers would be expected only rarely to cause death or permanent disability: in most cases, keepers would be expected to allow normal organismic operations to resume once the danger of suicide has passed.

4.3 Inputs: "Pain and Brain"

The design of a keeper must specify one or more informational inputs – signals of suicide risk that a keeper would use to activate itself. Several relevant implications follow from the "pain and brain" evolutionary account of suicide discussed so far.

4.3.1 The Emotional Experience of Pain as the Triggering Input Variable

The first implication follows from the central suicidogenic role of pain: emotional pain, meaning the emotional aversiveness of pain whether or not it comes with a physical component, by some algorithm combining its chronicity and intensity, would seem to constitute a logical, and perhaps the best available, cue for triggering

keepers. The pain would presumably need to be chronic to be worth triggering a keeper response – it would not serve the organism for a potentially disruptive anti-suicide mechanism to intervene if the pain is only anyway transient, especially as suicides generally take time to plan and organise (Joiner, 2010). The pain input would presumably also be subject to some contingency relating to its intensity, perhaps as a threshold condition or, more likely, by a proportionate, graduated sensitivity, on the logic that the more intense the pain, the more urgent the organism's motivation for escaping it.

It could be argued that pain is not an ideal index of suicide risk: a more precise and direct indicator might be the individual's planning and organisation of an actual suicide attempt. In the real biological world, however, suicidal ideation as an internal regulatory variable is probably unevolvable, partly because the brain's autonomic systems are unlikely to be able to decipher the narrative contents of high-level cognition in that way: by all accounts the informational currency of the brain is emotional rather than verbal (LeDoux, 1996; MacLean, 1990; Panksepp, 1998). There is also the practical consideration that not all thoughts about suicide are serious in their intent – keepers, whose defensive actions might be drastic – should not automatically trigger on the strength of what could be merely casual or philosophical musings.[1]

Although it would constitute only a proxy, indirect measure of suicide risk, emotional pain would probably nonetheless offer an effective, efficient input cue for the purpose of a keeper: effective, given that emotional states are thought already to serve a similar informational purpose in moderating other psychological systems, coordinating superordinate behavioural responses (Ciompi, 1991; Faw, 2000; Tooby & Cosmides, 2008), and efficient because, as already discussed, the imperative to escape emotional pain probably provides the motivation to seek a cessation of consciousness (Shneidman, 1985).

With pain as its activating input, keepers would expectably activate following severe, and protracted or repeated, subjectively painful experiences. Reiterating a point already made, a counterintuitive, outwardly paradoxical but expectable outcome is that activated keepers would tend to be associated with *more* suicidal thinking and behaviour, not less. Suicidal ideation and attempts would be more common among those in whom keepers have activated, relative to those without activated keepers, because emotional pain would operate as the mutual causal factor, simultaneously motivating suicidality, as well as providing an input cue to the reactive defences designed to prevent suicide.

[1] It ought to be possible to consider the possibility of suicide without accidentally setting off a potentially drastic autonomic defence. Some people report such idle thoughts to be positively soothing – as Nietzsche wrote, "the thought of suicide is a great consolation: by means of it one gets through many a dark night." S. L. Brand, Gibson, and Benson (2015) indeed provide empirical support for the idea that possession of a suicidal plan can reduce stress and protect against actual suicide.

4.3.1.1 Sensitive Triggering and Frequent False Alarms

As a biological pattern, severe fitness threats are typically addressed by defensive systems that trigger sensitively and, on a "better safe than sorry" principle, tolerate a high incidence of false alarms (Woody & Szechtman, 2011). The fitness threat of suicide – death – would appear to constitute an extremely grave threat (see 1.3 above), and hence the keeper systems that mobilise to meet it would expectably be commensurately easily activated and be characterised by frequent false alarms.

There are bound in any event to be false alarms arising from the use of pain as a proxy measure of suicide risk. As already suggested, there would expectably be a close statistical correlation between suicidal thoughts and the triggering of keepers, because both would be spurred by the experiencing of emotional pain. But the causal connection between keepers and suicidal ideation would be only indirect, and it might be possible to have one without the other. Triggered by pain, rather than by suicidal ideation itself, a keeper might mobilise in a pained individual without him having any actual thoughts of suicide – such an individual may be reasonably baffled as to why the mechanism should have activated. It would not be apparent to the individual that the system is operating on the basis of an actuarial risk assessment, an algorithm developed by "trial and success" over an evolutionary timescale: it would arise from the power of emotional pain as a predictor of suicide, and from the gravity of suicide as a fitness threat, and independently of the semantic content of conscious thoughts.

4.3.1.2 Slow, Gradual, Delayed Demobilisation

If and when the triggering pain subsides, a keeper would respond spontaneously by demobilising itself, in accordance with the reduced statistical risk of suicide. However, consistent with the pattern typical of animal responses to severe fitness threats and especially in the absence of a positive, unequivocal "all clear' signal (Woody & Boyer, 2011), the standing down of a keeper would expectably be delayed, gradual, and slow. As with the high rate of false alarms already mentioned, the cautious deactivation characteristic of keepers would not necessarily indicate dysfunction: even though the individual may no longer have, or perhaps never have had, actual thoughts of suicide, the keeper may nonetheless have correctly operated in accordance with its actuarial assessment of suicide risk.

4.3.1.3 Outputs Calibrated in Line with Intensity/Chronicity of Pain Input

The behavioural output of a keeper ought to be calibrated to some degree in response to the level of pain input. As presumably the more chronic and intense the pain, the more urgent the motivation to seek suicidal escape from that pain, keepers would expectably exploit this association by adjusting the severity of the output defences accordingly.

4.3.1.4 Quantity of Pain, Rather than Quality, Is the Relevant Input

Since a suicidal escape is posited to be motivated by the aversive experience of mental pain generally (3.1.1 above), the specification would not need to concern itself with the particular variety of pain that is hurting, except inasmuch as some types of pain might hurt more than others. The input cue might be any blend of shame, guilt, grief, loneliness, burdensomeness, meaninglessness, hopelessness, anomie, physical pain, and any other forms of misery. Shneidman’s (1993) concept of “psychache” as a catchall synonym for mental pain (Meerwijk & Weiss, 2011; Tossani, 2013) would probably align with the needs of the input specification well, potentially acting as the common stimulus both of suicide and of the reactive systems designed to avert it. Similarly, the specification would not be concerned with the specific origin of the suicidogenic psychache – it could be abuse, loss, rejection, deprivation, trauma, or another form of adversity.

Keepers would be expected to activate more frequently and/or more powerfully in people more prone to experiencing emotional pain, recognising individual differences in pain tolerance that might arise for various reasons, perhaps due to genetic, developmental, social, cultural, and other particular circumstances.

4.3.1.5 Keepers May Become Dysfunctional

An imperfection implied by this design is that the activation, by pain, of a keeper may itself generate more pain. A secondary pain may arise as a side effect of the defence’s attenuation of the individual’s cognitive capabilities, for example, through a collateral impairment of the individual’s social functioning. A potential circularity might thus arise, of pain breeding pain, creating scope for positive feedback and, to borrow a term from electronics, the latching of the system in its maximum possible pain state. On this basis, there is a perhaps unavoidable risk of sometimes extreme, dysfunctional outcomes inherent in the specification. A keeper system may itself become pathological.

4.3.2 Brain Maturity as a Developmental Condition

An important developmental proviso needs to be added to the input specification to take account of the threshold of cognitive competence apparently necessary for suicide to be conceivable and enactable. As discussed earlier (see 3.2.1 above), suicide does not generally emerge as a serious risk until the early teen years (Beautrais, 2001; Nock et al., 2013), a discontinuity that likely marks a species-typical development stage after which suicidal plans can be mentalised and implemented (Shaffer, 1974). So, mental pain as an activating cue should be qualified by a further input condition: natural selection responding to the recurring developmental pattern, keepers would mobilise only at or just ahead of the life stage when suicide becomes a significant threat – at around early adolescence.

4.3.2.1 Puberty as a Proxy Index of the Cognitive Capacity for Suicide

The qualifying developmental signal might be hormonal, perhaps related to the onset of puberty, not because puberty itself is necessarily suicidogenic (although no doubt it can be a difficult time of life) but because puberty appears closely to precede the emergence of the intellectual capacity for suicide and because puberty is associated with biochemical signals used for other, probably evolutionarily pre-existing, developmental systems, including those that organise the development of the brain. If puberty does provide such an input, then keepers may well activate even in adults who lack the cognitive capacity for suicide, perhaps due to brain damage or intellectual retardation, on the grounds that the keepers' algorithm may nonetheless infer an actuarial risk from the combined input signals of emotional pain and puberty, regardless of the individual's actual intellectual functioning.

Reiterating the point, whatever the precise developmental input, it can be predicted that keepers should generally mobilise in response to emotional pain shortly, and only shortly, before the species-typical timing of the first onset of suicidality – in other words, around the early teenage years: even intense, chronic psychache should not trigger a keeper earlier.

4.3.2.2 Keepers Would Be Species-Typical and Species-Specific

Suicide being apparently species-specific and species-universal, it can also be predicted that keeper defences should also be both species-specific and species-universal. Keepers would be found in no other animal than humans, although rudimentary evolutionary homologues of at least some components of keeper systems may be observable in our closest mammalian relatives; signatures of what would have been the raw material from which keepers, as specifically human adaptations, emerged.

Among populations of mature humans, however, although patterns and proximal causes of emotional pain may vary, essentially the same suite of keepers as a species-universal system should expectably be found, activating in pained adolescents and adults in all cultures and across all historical eras.

4.4 Design Features of Keeper Responses

Activated by intense and enduring mental pain, from adolescence onward, keepers would be expected to respond with cognitive and behavioural countermeasures designed to reduce the risk of suicide. It is important to be clear about the point of reference for this risk reduction: risk will be reduced compared to the suicidal state that theoretically would have prevailed in a pained individual were it not for keeper interventions. As has been noted already, the suicide risk associated with mobilised keepers would not be reduced compared to the general population: indeed the suicide

risk of those experiencing keepers would be inflated compared to the general population, because keepers would selectively activate among those at risk, and will be designed to achieve only a partial downgrading of that risk (see 4.2.1. above). An analogy may be drawn with the physiological immune system: an immune response to infection has the effect of reducing mortality not compared to the general population, many of whom may be uninfected, but compared to the imaginary mortality that would have occurred were it not for the activation of the immune system.

Some general design specifications and other inferences may be made about these countermeasures.

4.4.1 "Pain and Brain" Model of Suicide Implies Multiple Mechanisms by Which Keepers May Forestall Suicide

A keeper would have been favoured by natural selection for its effectiveness in averting suicide, but what specific behavioural measures could such defences take? The hypothesised "pain and brain" evolutionary co-authors of suicidality point to two conceptually, and perhaps neurologically, distinct fields of opportunities: (A) keepers could weaken the motivation for a suicidal escape by downregulating the aversiveness of mental pain; and/or (B) keepers could interrupt the cognitive means of suicide, by measuredly reducing the individual's capacity to conceive of, plan, and enact a suicide. The strategic aim would be temporarily to attenuate affective and cognitive functioning respectively, sufficiently to avoid suicide, while maintaining the organism's operations at a generally survivable level.

It is possible to intuit a variety of tactical ways in which these "pain and brain" anti-suicide strategies might translate into specific countermeasures, any of which might be expected to obstruct the path to suicide, singly or in combinations – some of these specific interventions are tentatively hypothesised later in this chapter. The point to make for now is that the "pain and brain" model of suicide's evolution points to there being multiple forms of keeper – some that attack the affective motivation for suicide, others that downgrade the cognitive capability for suicide, and perhaps others that deploy both strategies in varying blends.

4.4.2 Keeper Responses Will Be Strongly Involuntary and Subject to "Instinct Blindness"

Keeper responses can be specified as involuntary and autonomic. Generally in nature, unusual but catastrophic events – rare bushfires, for example – can exert great selective power, more so than moderate, frequent threats of harm (Woody & Szechtman, 2011, 2013). Indeed, lethal threats so infrequent that they are unlikely to be experienced within an individual's lifetime have been found to induce

genetically fixed defences that can endure for thousands of generations (Wagner, 2003). In animals, defences against such rare lethal threats tend to be what Williams (1966) classes as obligate – they are typically involuntary, instinctive systems. This is primarily because there is limited opportunity for, and little point in, an organism learning by trial and error how to protect itself from a hazard that offers few trials and where to err can be fatal (Fessler & Machery, 2012; Rachman, 1977). Suicide would seem to fall clearly into such a category – it is by definition a mortal and potentially once-in-a-lifetime fitness threat. The design of keepers should therefore specify strongly instinctual responses: keeper interventions should not rely on learned behaviours but follow programmes controlled largely by autonomic systems. Neurologically, they are likely to be characterised as primary processes (Panksepp, 1998; Panksepp & Watt, 2011), operating in anoetic consciousness – experience, without understanding (Tulving, 2002), and will arise from the brain's subcortical, reptile regions (MacLean, 1990).

Given the severity of suicide as a fitness threat, there should be no easy way for keepers' defensive interventions to be consciously overridden: they would operate compulsively. Until and unless the source pain input is relieved, any conscious override over a keeper response, if possible at all, would be temporary. To illustrate by analogy, it is possible consciously to stop breathing but only for a while: sooner or later an instinctive obligate imperative to breathe will override conscious intent, however hard one tries to hold one's breath. By the same token, as outlined above (4.3.1.2), once the triggering pain is lifted, keepers would be expected to demobilise spontaneously, in time, without requiring direct conscious modulation.

Keepers would largely operate not only beyond the reach of conscious control but also at least partly outside of conscious understanding. Indeed, their effectiveness may depend on the individual not being fully aware of their action, a possible incidence of the phenomenon of instinct blindness (Cosmides & Tooby, 1994) discussed in the Introduction (1.6.2). The anti-suicide value of a cognitive distortion, for example, might be fatally undermined if the individual fully perceived it to be a distortion.

4.4.3 Keepers Would Be Functionally Interchangeable: They May Operate Concurrently or Sequentially

Multiple classes of keeper can be conceived: one class ameliorating the pain motivation for suicide, another degrading the cognitive means to carry out suicide, and perhaps others doing blends of both. The theoretical potential for there being multiple keepers may make for an opportunity too good to miss for the organism, to the extent that multiple instantiations may be not only possible but likely, for at least two reasons. First, given the gravity of the outcome (death) if the defences fail, multiple defences would be expected to operate as a matter of insurance or redundancy – following the principles of putting one's eggs in more than one basket or

wearing both belt and braces. It is for this reason that we are normally equipped with two kidneys, two gonads, etc., but it also explains why, in the interests of system robustness, many distributed and different parts often contribute to system functions in biology (Kitano, 2002; Wagner, 2005). Second, the objective of preventing suicide without incidentally killing the organism in the process implies, on the face of it, a highly complex and delicate task: it would require the individual's emotional and intellectual capabilities to be degraded enough not to permit suicide but well enough for the organism still to function at some serviceable level in its society. On this basis it could be expected that keeper defences would involve a spread of mildly disabling design compromises, diversified so that no individual kludge is so hypertrophied that it risks hobbling vital faculties. By analogy, a solution to the obstetric dilemma, as it will be recalled (3.3.2 above), does not rely on an extreme reshaping of the pelvis alone, or on an extreme overlapping of plates in the newborn's skull alone, or on extreme natal immaturity alone, or on rotational birth, or on obligate midwifery, but is achieved rather by a combination of different, moderate accommodations: operating together, these smaller compromises together facilitate successful parturitions while allowing the other essential design tasks of the pelvis and skull, albeit imperfectly, to be met.

So, if they are mutually compatible, multiple keepers would expectably mobilise in combinations in the same individual: mutually incompatible keepers might trigger in the same individual but at different times. The primary point is that different varieties and blends of keepers, despite their likely appearance of being discrete, unconnected phenomena, would be functionally equivalent and potentially interchangeable – instigated by the same input cues (pain and probably puberty) and designed to achieve the same goal (to downscale suicide risk). By analogy, while one could observe a hovercraft, a canoe, and a horse and see categorically distinct objects, they could also be viewed functionally as a class of resources any of which may in principle be used to get from A to B. As Bowlby (1969/1997) commented, with regard to the diversity of human instinctual behaviours, there may be many ways to reach Rome. For the purpose of the organism's survival, it may matter little which particular combination of keepers is mobilised, provided that they achieve the unitary goal of forestalling suicide.

4.4.4 Protracted Anxiousness as a Common Feature

In keeping with the severe, uncertain nature of suicide as a fitness threat, keeper responses would expectably be accompanied by a state of generalised, free-floating anxiety. Among mammals, humans included, different types of fitness threat tend to be met with characteristically different styles of defence (Neuberg, Kenrick, & Schaller, 2011; Woody & Szechtman, 2011). Fear is the universal mammalian reaction to an immediate, specific danger – fear being manifest by a set of evolutionarily ancient fight/flight/freeze reactions. Anxiety, on the other hand, is the typical response to uncertain, ambiguous, non-specific threats, which tend to arouse a

patterned suite of precautionary, security-promoting behaviours. To deal with an ambiguous hazard, mammals generally tend to stop and attend concertedly to its possible source, with the aim of acquiring further, actionable, information (Blanchard, Griebel, & Nutt, 2011; Blanchard, Hynd, Minke, Minemoto, & Blanchard, 2001; Corr, 2008). Unlike fight/flight/freeze-triggering threats, ambiguous threats by their nature have to be more inferred than detected, requiring the organism to "go beyond the information given" (Bruner, 1973; Waldmann, Hagmayer, & Blaisdell, 2006). Perhaps linked to this imperative to infer, the characteristic anxiety-type response among humans includes an additional, apparently species-specific, tendency for mental rumination (Blanchard, Griebel, Pobbe, & Blanchard, 2011).

To locate suicidality in this universal threat-response framework, a heightened risk of self-killing could arguably be categorised as an ambiguous rather than a specific one. The source of a suicide danger is multiply indeterminate: a lethal attack, of uncertain nature, may strike at an unknown time and from no particular direction. The primary cue of suicide risk, intense psychological pain, may itself have been induced by only a vague, ambient social or existential threat. On this basis, a raised risk of suicide would represent the kind of hazard against which the organism's best strategy is prototypical, protracted anxiousness (Woody & Szechtman, 2011) – to remain in a state of general alert while it tries to ascertain enough about the threat to decide what to do. Whether there is conscious awareness of the suicide danger or not, a human organism experiencing enough pain to be at a statistical risk of suicide – facing, that is, an uncertain, invisible, and severe fitness threat – could reasonably be said to have good cause for worry, rumination, and free-floating anxiety. Viewed from the outside, the social or other problems that originally caused the pain might look in themselves relatively unimportant: the suicidogenic potential of the pain, however, has the potential to magnify the problems' gravity into a matter literally of life or death. It follows that keepers would probably be characterised not just by a generalised, protracted anxiousness but by a compulsive focussing of the individual's attention onto the triggering pain and the intentional message it may carry, perhaps as urgently as if his life depends on it, which well it might. There may be, for this reason, a biological basis to support the assertion made by Bateson, Brilot, and Nettle (2011) that however disproportionate an individual's anxiety appears to others, and even to the individual, it may be that the individual is anxious because he or she is, in fact, right to be anxious.[2]

[2] A heuristic suggested by Williams (1966) is that natural selection and mankind can independently reach similar solutions to the same problems (e.g., a bird's wing/an aeroplane wing, the heart/a pump) – although such confluences of biological and human engineering outcomes are by no means the rule (Vogel, 1998). It is at least interesting to note that close, continuous monitoring of high-risk inmates is a recurring theme in the suicide prevention protocols of prisons and other institutions (Daigle et al., 2007; Konrad et al., 2007). On this basis, an autonomic anxious vigilance, perhaps analogous to suicide watch, might be expected in a human organism at risk of suicide.

Generalised, free-floating anxiety, while it would be expected to accompany the mobilisation of keeper mechanisms, would not reasonably constitute a keeper in its own right. Anxiety is, rather, a general response tendency; it would not instantiate uniquely to address the threat of suicide – unlike keepers, which evolved for the specific purpose of obstructing suicide.

4.4.5 Keepers May Make the Individual Appear to Behave Irrationally

As a perhaps unfortunate consequence of the above design requirements, individuals compelled to comply with the instinctual demands of keepers might look and feel as if they are thinking and behaving irrationally. Affective systems and/or high-level intellectual faculties would expectably be degraded and potentially severely. It would be all but imperceptible both to the individual and to observers that a protective balance is being struck, between controlling a dangerously raised risk of suicide and introducing new fitness risks due to the side effects of the defences. While the actuarial, statistical benefit of a moderated suicide risk would be invisible to the individual, the costly behaviours and mental states induced to bring about that benefit may be both signal and apparently functionless. Keepers, operating healthily and normally, may well make the individual feel and appear mentally deranged.

4.5 Specific Types of Keeper Responses

There might be a great variety of tactical means by which keepers could be hypothesised to forestall suicide, within the two general domains in which keepers would operate – suppressing the pain motivation for a suicidal escape (*pain-type* keepers) and/or impeding the intellectual and psychomotor capability to plan and undertake a suicide attempt (*brain-type* keepers). Intuition suggests some possibilities, outlined in the following speculations. This may not be an exhaustive account.

4.5.1 Pain-Type Keepers: Making Suicide Unnecessary

A keeper mechanism could, hypothetically, remove or reduce the motivation for suicide by making psychache bearable, downregulating its emotional aversiveness and thereby lessening the impetus to seek escape. From a design perspective, the mechanism would, in doing so, ideally leave the intentional component of a pain signal intact – shame, guilt, loneliness, and so on – in order that the pain should

continue to meet, at least in part, its presumed adaptive function of alerting the organism to specific threats to vital social relations and meaning systems. Physical pain, at least, is so regulated, according to neurological theory: the brain appears to contain stress response systems that filter the perception of pain homeostatically, altering the processing of pain-producing information to control its impact (Loeser & Melzack, 1999; Melzack, 1999). If these neurological mechanisms were co-opted for the regulation of emotional pain, as appears to be the case with regard to other aspects of pain systems (Eisenberger & Lieberman, 2004, 2005; Etkin, Büchel, & Gross, 2015), then this neural raw material may have been available for the emergence of keeper mechanisms.

The amelioration of psychological pain might be achieved in a number of ways, perhaps including the following "pain-type" keeper responses.

4.5.1.1 Numb the Pain

As a first hypothesised category, there may be several possible mechanisms by which the organism could dull the aversiveness of psychache directly.

(i) *Autonomic numbing of affect.* A general, endogenous numbing of emotional pain might be achieved automatically by a process perhaps homologous to the emotional analgesia that can occur in response to traumatic stress (Foa, Zinbarg, & Rothbaum, 1992; Monson, Price, Rodriguez, Ripley, & Warner, 2004; Tossani, 2013). A question arises whether the brain is capable of selectively targeting painful emotions – shame, guilt, loneliness, etc. – without also suppressing other, pleasurable affects. If it is not – which is plausible in view of the generalised analgesic effect of traumatic stress – then a keeper may induce a softening of the dominant psychache but at the expense of a general deadening of emotional responses of any valence or quality. An outcome of such a general downgrading would presumably be that individual might report feeling little or nothing except the residual, dulled, misery.

(ii) *Self-medicate the pain.* As physical pain can be numbed exogenously by the use of pain-relieving substances, it is conceivable that a keeper could operate along similar lines, guiding a compulsive self-medication with naturally occurring analgesics. Such behaviour would find evolutionary homologues in the instinctive self-medicating behaviours by which sick non-human animals exploit selected plants and other pharmaceutical resources in their environments (Engel, 2002). An involuntary self-medication could also be an effective strategy for a brain-type keeper, depending on the substances used: sedation with naturally occurring depressants would serve to degrade the cognitive and psychomotor capacity to carry out suicide. Combining the two functions, it might be inferred that the substances most likely to feature in a keeper response, if they are available, would have both depressive and analgesic properties.

(iii) *"Pain inhibits pain"*. A keeper mechanism might exploit the phenomenon of pain offset relief, by which one pain may be downregulated by self-administering another, unrelated, pain signal. Physical pain can be eased by inducing another (rubbing, gripping, etc.), a phenomenon that is a matter of both commonplace experience and accepted neurological theory (Melzack & Wall, 1967; Moont, Pud, Sprecher, Sharvit, & Yarnitsky, 2010). Psychological pain appears to be controllable by what may be an analogous or homologous process (Biro, 2010; Franklin, Aaron, Arthur, Shorkey, & Prinstein, 2012; Heilbron, Franklin, Guerry, & Prinstein, 2014). If the phenomenon were co-opted for anti-suicide purposes, then a measured, but nonetheless compulsive, self-injury might be an expectable outcome behaviour of a keeper mechanism.

4.5.1.2 Distract or Detach from the Pain

As well as, or instead of, regulating pain directly, other forms of keepers might evade emotional pain either by distracting the organism's attention away from the pain onto some other focal concern and/or by providing the organism's perceptual and meaning-making systems with a less painful reality to live in. In both cases, the mechanism may involve illusory beliefs.

(iv) *Distract from the pain.* Related to, but conceptually distinct from, a pain-inhibits-pain response, distraction is known to have a powerful effect in disrupting the impact of physical pain (Bushnell, Čeko, & Low, 2013; Johnson, 2005; McCaul & Malott, 1984; Villemure & Bushnell, 2002). Along similar lines, a variety of obsessive preoccupations and compulsive behaviours might plausibly offer an effective autonomic diversion from emotional pain and can be proposed as a possible class of keeper. These preoccupations need not be directly connected with the source of the original pain. They may be unwelcome, inconvenient, and even antisocial: it may matter little for anti-suicide purposes what the particular focus of the obsessions and compulsions might be, provided that it distracts sufficiently from the pain on average to sustain survival.

(v) *Detach from painful reality.* A keeper might contain a safety device, perhaps along the lines of what McKay and Dennett (2009) describe as a doxastic sheer pin, that breaks part of the organism's perception of reality when that reality would be too painful fully to comprehend, in order to prevent the organism's destruction and to enable its continued functioning at an attenuated level. A physiological metaphor might be the breaking joints in the limbs of a lobster or the fracture planes in the tail of a lizard, designed to let a body part detach with minimal loss of blood and from which a replacement may regenerate. This strategy of defence, autotomy, by which the organism sacrifices part rather than lose the whole, is a recurring theme in biology (Huxley,

1942/1963). A psychological version, a system which provides the human organism with a provisional, survivable reality, might reasonably be expected to mobilise in situations where a realistic appraisal may be suicidogenically painful.

4.5.1.3 Find Meaning for the Pain

For humans at least, physical pain is experienced to be more bearable if reasons can be found for experiencing it and/or for bearing it, a feature of the individual's relationship with pain that is a matter of both commonplace experience and neurological science (Eccleston, 2001). At the extreme, such acquisition of meaning may be understood as an essential defence that weakens the power of intense pain to motivate suicide (Frankl, 1946/2011).[3] There may be many ways to look at meaning in adversity, and many ways by which meaning can influence mental well-being (Baumeister & Vohs, 2002; Bolton & Hill, 1996; Wong, 2012), but two seem intuitively pertinent to the management of suicidogenic pain and might form the basis of possible keeper specifications: both involve the creation of stories, either to explain the existence of the pain and/or to provide reasons to continue living with the pain.

(vi) *Making sense of the pain.* Humans find physiological pain easier to live with if they feel they understand it – if it has a comprehensible cause and fits within a system of knowledge (Eccleston, 2001). If a similar dynamic applies to emotional pain, then a keeper could be designed to compel an individual in emotional pain to find and embrace a narrative that explains it. If such a keeper exists, it can be predicted that, for the purpose of averting suicide, virtually any explanation for the emotional pain will do, real or fictitious, provided the explanation is convincing to the individual. Eccleston (2001) highlights the idiosyncrasy with which people accept reasons for their pain, cautioning that what makes sense to one person can be evident nonsense to another. Provided on balance it promotes survival, an effective explanation could be largely illusory and indeed delusional.

(vii) *Finding a reason to live with the pain.* Whether the individual understands the cause of his suffering or not, the maintenance of an overriding, countervailing motivation to stay alive in spite of the suffering appears to confer a powerful protection against suicide (Frankl, 1946/2011; Linehan, Goodstein, Nielsen, & Chiles, 1983; von Andics, 1947). Indeed, to have a compelling meaning and purpose in life – a payoff, or even the prospect of a payoff, that makes a painful life worth enduring – may constitute a human biological imperative

[3] Viktor Frankl (1946/2011) bears witness how ordinary people are able to sustain a sufficient will to live even in the extraordinarily adverse environment of a death camp and avoid suicide, provided they hold strong personal rationales for enduring the ordeal. In the preface to Frankl's book, Allport (2011, p. 9) connects this testimony to an axiom of existentialist philosophy and therapy that "to live is to suffer, to survive is to find meaning in the suffering."

(Klinger, 1977, 2012).[4] A design specification for a keeper could therefore include a requirement that emotional pain be met with an urge to find, or invent, a sufficiently compelling reason to live despite it. Continuing what is emerging as a theme, provided the reason to live makes sense to the individual and confers a net survival benefit, almost any reason will do, however illusory or transient: there need be little objective rationality observable in the manifestations of an effective keeper mechanism.

4.5.2 Brain-Type Keepers: Making Suicide Difficult to Plan and/or Do

As well as, or instead of, pain-type keeper defences that soften the suicidogenic aversiveness of psychache, other, brain-type, keepers would be anticipated to restrict the individual's cognitive access to lethal means of suicide.

(viii) *Degrade cognitive ability to plan and enact tasks.* In order to disable the individual's capability to organise a "successful" suicide endeavour, indecisiveness, memory loss, a generalised fear of action, and/or other impairments of high-level cognitive faculties, sufficient to interfere with the individual's ability to formulate and enact complex plans, would be expected to emerge at times of detected suicide risk. The individual would, however, be expected to remain capable of basic somatic and cognitive operations, sufficient for the minimal needs of survival.

(ix) *Loss of psychomotor energy.* Even if capable of planning suicide, individuals in extreme emotional pain may find themselves physically unable to follow through with their suicidal plans. A protective lethargy might be expected to instantiate, perhaps escalating into a state close to paralysis at times of highest risk. Again, this attenuation of psychomotor capability would be measured and in general survivable: it should permit at least a continued somatic functioning of bodily systems.

These suggestions – specific, hypothesised, pain-type, and brain-type keepers – are offered tentatively. Not every conceivable solution to an adaptive problem is necessarily evolvable, natural selection operating within phylogenetic constraints (Gould & Lewontin, 1979). There may well be other plausible mechanisms beyond those posited here, by which pain-type and/or brain-type keepers may respond to psychache, in adolescence and adulthood, with the purpose of obstructing suicide. The general point of these illustrations is that multiple adaptive solutions are possible and, indeed, recalling the value of system robustness and redundancy posited earlier (4.4.1 and 4.4.3), probable: a threat as grave as suicide would expectably be met by an integrated suite of psychological defences.

[4] Camus (1955) may be adverting to a biological reality when he says that to kill oneself is to admit that life "is not worth the trouble." The point is discussed in more detail in Chap. 6.

4.5.3 Different Blends of Keepers May Instantiate to Reflect the Needs of Individual Differences

Suicide defences, if they are to work optimally, may not appear as a one-size-fits-all solution: each individual has a profile of traits, social roles, and risks, which ought ideally to be reflected in the defences mobilised to block the individual's suicidal trajectory. The potential for multiple varieties of keeper may create scope for flexibility in their instantiation to accommodate individual organismic needs. For example, it can be envisaged that a nursing mother would be best protected by mechanisms that impaired her capacity to plan or enact suicide while still functioning at a basic, if attenuated, level as a mother, in a domestic setting. In contrast, a potentially suicidal male whose reproductive fitness depends on his continued leadership of a hunting or raiding group would be better served by mechanisms that control his suicidality while permitting his continued, if attenuated, action away from the camp. The question of why one keeper as opposed to another might deploy in a particular pained individual at a particular time – perhaps influenced by gender, personality disposition, biographical background, and other genetic, developmental, cultural, and other personal circumstances – might be intriguing. Indeed the question may be of intense interest to the individual experiencing the keepers' actions, but, in the context of reproductive fitness and the interchangeable functionality of keepers, it may be immaterial.

4.6 Summary and Conclusions

This chapter has presented arguments that point to a score of features that would constitute a reasoned engineering specification for keepers — a system of last-line, anti-suicide, evolved psychological mechanisms. These characteristics, which could be taken as evidence of special design, suggesting that such devices evolved by natural selection specifically for the purpose to avoiding or forestalling suicide, are summarised in Fig. 4.1 (below).

In addition, developing and illustrating item (g) in Fig. 4.1, nine specific forms of keeper responses have also tentatively been suggested – potential ways in which an autonomic system might either weaken the suicidogenic force of pain (pain-type keepers) or interfere with the individual's ability to organise a suicidal act (brain-type keepers) – summarised in Fig. 4.2. The two ellipses (…) in this table, under the numbered keepers, are intended to indicate that the lists may not be exhaustive.

Expressed more graphically and building on the pro forma diagram shown at the end of the previous chapter (Fig. 4.3, p146 below), hypothesised keeper systems may be visualised, as in Fig. 4.3, as an imperfect defensive barrier or a very nearly fail-safe safety net. Keepers, according to this scheme, function to intercept the potential self-killings that arise from the "pain and brain" generator of suicidality, with only a minimal number of actual completed suicides falling through the net.

"Pain" input	a) Keepers would be activated by chronic, intense, pain (subject to the developmental condition of a "brain" input).
	b) Input variable would be the unidimensional aversiveness of pain, regardless of the pain's source or quality.
	c) Keeper responses would be calibrated so that the intensity of defensive outputs accords with the intensity and chronicity of the pain input.
"Brain" input	d) Keepers would not activate earlier than the species-typical age of first onset of suicide, in early adolescence, possibly signalled by the onset of puberty.
Deactivation	e) Keepers would demobilise spontaneously following a reduction in originating pain input.
	f) Deactivation would usually be slow, gradual and delayed, especially without an unambiguous 'all clear' signal.
Specific types of keeper responses	g) Responses would aim to limit motivation for suicide ("pain-type"); or limit the capacity to organise suicide ("brain-type") – see Figure 4.2, below.
General characteristics of keeper responses	h) Keepers would drive compulsive and involuntary behaviours, resisting conscious awareness and intervention.
	i) Multiple forms of keepers are likely to operate in an integrated fashion in the same individual, concurrently and/or temporally.
	j) Keepers are likely to be accompanied by protracted anxiousness, and rumination focused on emotional pain.
Goals and trade-off considerations	k) The compromise objective would be to minimise the risk of suicide, while limiting the imposition of new, potentially drastic, fitness costs arising from the activated keeper.
	l) Keepers would trigger sensitively, with a high incidence of false alarms – many affected individuals will not have considered suicide.
	m) Keepers may themselves become pathological.
Manifestations of successful operation	n) Keepers would result in a low, but above-zero, incidence of suicide in human populations.
	o) The residual suicides would be intrinsically unpredictable at the level of the organism.
	p) Activated keepers would be associated with suicide, but only inasmuch as they associate with suicidal ideation rather than with the enacting of those ideas. Most suicides would expectably be accompanied by activated keepers.
	q) Keeper responses would be nearly always recoverable and survivable: they should only rarely cause permanent disability.
	r) Individuals experiencing active keepers may look and feel as if they are thinking and behaving irrationally.
Species-specific and species-universal	s) Keepers would be species-specific: they would not occur in non-human animals, although homologues of their features may be found in other mammals.
	t) Keepers would be species-universal: the same integrated system of keepers would be found activating among populations of mature humans in all cultures and historical ages.

Fig. 4.1 Summary of some general design features of hypothesised keepers — reactive, last-line, anti-suicide defences, discussed in Chap. 4

"Pain-type" keepers: weakening the motivation for suicide.	(i)	Autonomic numbing of painful (and possibly all) emotions.
	(ii)	Compulsive self-medication with analgesics.
	(iii)	Pain offset relief: compulsive self-administration of other pain.
	(iv)	Distract from pain: preoccupations, possibly unrelated to the pain source.
	(v)	Detach from unbearably painful reality: break 'doxastic sheer pin'.
	(vi)	Make sense of the pain: invent a narrative to explain its existence.
	(vii)	Find a reason to live with pain: possibly illusory or delusional.
	...	
"Brain-type" keepers: reducing the means to organise suicide.	(viii)	Degrade general ability to plan and enact tasks.
	(ix)	Loss of psychomotor energy.
	...	

Fig. 4.2 Summary of posited types of keepers discussed in Chap. 4

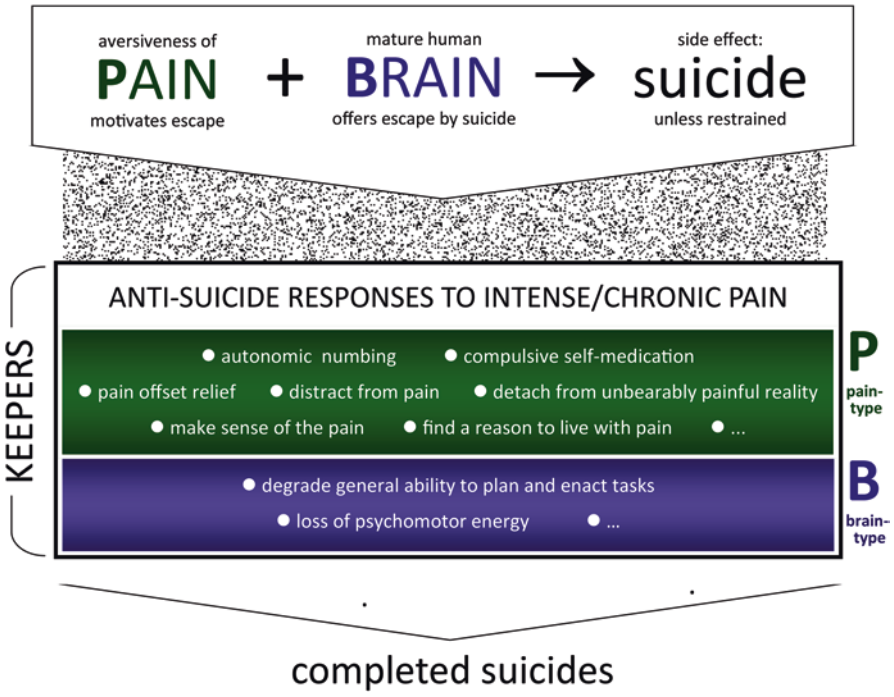

Fig. 4.3 Keeper defences as a hypothesised defensive system, forestalling almost all potential suicides

The template of keeper system design set out in this chapter invites, as the next step, a review of whether matching phenomena can be found in the real world, in extant human populations. The narrowness of the specification should, it is hoped, make a search meaningful and manageable. It is clear, for example, that while keepers would necessarily entail some level of affective and/or cognitive impairment, it is not the case that *any* mental or other disability could reasonably be classed as a keeper. Keepers would be expected to operate in manner akin to a physiological immune response, defined by its systematic functionality, and certain boundary criteria can be set out on that basis. For example, as has been argued in this chapter, keepers would selectively actuate only in those individuals whom the organism detects, by the pain and brain criteria, to be at a raised statistical risk of suicide, and only then in a measured response to that risk. They would spontaneously, if cautiously, deactivate once the triggering pain is relieved – although they may subsequently reactivate in the same individual if the pain recurs. Being designed for the purpose of protecting reproductive fitness, they would leave very few people permanently disabled, and they would have to be generally survivable, or they would confer no fitness advantage over the suicide they are designed to avert.

With this chapter's design parameters in mind, the next chapter will explore the question of whether forms can be found in real life that meet the functional specification of hypothesised keepers.

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Chapter 5
Common Mental Disorders (CMDs) as Keepers

When I see a bird that walks like a duck and swims like a duck and quacks like a duck, I call that bird a duck.
James Whitcomb Riley (1849–1916)

To summarise the argument so far, earlier chapters reason that an unfortunate combination of two important adaptions – "pain and brain" – can account for the evolution of suicidality in the human species. Pain makes a biological demand for escape action, while the intellect of the mature human brain brings with it the capacity for intentional self-killing as a means to satisfy that demand. If this is so, then natural selection would be expected, integrally with the evolution of human cognition, to have promoted powerful countermeasures which detect suicide risk and respond to prevent the organism from intentionally extinguishing itself. Providing the motivation and the means, respectively, for self-murder, "pain and brain" arguably constitute sufficient conditions for suicide, unless some countervailing force or forces block the path. That such countermeasures exist can be inferred from the rarity of suicide in modern human populations. As a step towards identifying these defences, the previous chapter hypothesised a class of reactive systems, keepers – last-line, anti-suicide, evolved psychological mechanisms – and predicted twenty features of their likely design. These include the experience of chronic, intense emotional pain as an input cue of suicide risk, subject to a developmental conditional – keepers would activate only at or after the life stage when suicide becomes cognitively possible, this usually being sometime around puberty. Keepers would seek to lessen the risk in those in danger by attenuating suicide's "pain and brain" drivers, by ameliorating the experience of pain, by degrading the organism's capacity to organise suicide, or by a combination of the two strategies. Keepers would result, it was argued, in a low, but above zero, rate of suicides. The residual incidents would usually be associated with activated (but failed) keepers, and this residue would be intrinsically unpredictable on the grounds that natural selection would probably already have exploited and exhausted whatever usefully predictive

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informational inputs are available to the organism's own systems – deaths that could have been averted would have been averted. The activation of keepers would correlate closely with suicidal thoughts because both suicidal ideation and keeper responses would arise from the same root cause of chronic, intense emotional pain: but keeper activation would not be expected to correlate strongly, if at all, with the progression from suicidal thoughts to suicidal action, because actual suicides would, by definition, have been beyond the capacity of anti-suicide defences to forestall. It was proposed that multiple types of keepers would be expected to emerge as a suite of functionally equivalent mechanisms – activated by the same inputs and sharing the same anti-suicide goal. The previous chapter tentatively suggested several specific types of keeper response that might reasonably be expected. So, given this briefing as a kind of naturalist's field guide, the question is now asked: Is there any evidence that hypothetical keepers exist in reality? Can we point to psychological phenomena that match the *a priori* design specification?

The design proposed in the previous chapter would suggest that, if they exist, empirical evidence of keepers should not be hard to find: a little reflection on the implications of their design features would lead one to expect keepers to produce commonplace, disturbing, and conspicuously bizarre outcomes. One might consider, for example, the counterintuitive oddity of keepers' general mode of response to stress. As was discussed in Chap. 3 (3.1.2 above), emotional pain as a biological signal is presumably meant to alert the organism to an ongoing threat to its survival or reproductive fitness (Bowlby, 1969/1997; Eisenberger, 2011, 2012a, 2012b; MacDonald, Kingsbury, & Shaw, 2005; Panksepp, 2015; Panksepp & Panksepp, 2000). Precisely when an animal would be expected to marshal all its cognitive resources to the task of combatting such a threat, the keeper design specification predicts that adolescent and adult humans may find their mental faculties subverted – their emotional acuity blunted and/or their capacity for rational thought and action weakened. If the specific forms of keepers hypothesised in Chap. 4 activate, then chronically pained individuals are likely to be prone to a variety of mental impairments. (Roman numerals in this paragraph cross-refer to items in Fig. 4.2, p. 146). Some might find themselves unable to feel much emotion (i) or compulsively consuming psychotropic substances (ii). Others may find themselves compelled mildly to injure themselves (iii), while others may become obsessively preoccupied with arbitrary, arguably delusional, concerns (v, vi, vii). Some may struggle to think clearly, take decisions, remember things, or organise tasks (viii), perhaps becoming so incapacitated that they can hardly leave their homes or beds (ix). Some, perhaps most, will experience a mix or succession of such handicaps. As long as the source pain persists, these apparently self-defeating psychological states will strongly resist conscious moderation. They are likely to be accompanied by a non-specific, free-floating anxiousness and compulsive rumination. Any outcome short of death being preferable in fitness terms to suicide, emotions may be so deadened, and/or higher cognitive operations so disrupted, that an adult human in extreme and chronic psychache may be able to manage little more than basic

bodily functions. All such impaired states will systematically associate with strongly aversive emotions and, perhaps most distressingly, with suicidality – suicidal thinking, occasional attempts, and some actual deaths. With no fair point of reference available to measure against, the fitness upside delivered by these protective measures – a reduction of actuarial suicide risk below what it theoretically would have been without them – will be invisible both to the individual and to observers.

It would be surprising if people beset with such aversive, intractable, and apparently inexplicable disabilities, and the sufferers' kin did not routinely approach priests, healers, medics, and the like, seeking counsel and remedial interventions. It would follow, then, that a search for real-life phenomena that might fit the specification of keepers theorised in Chap. 4 should not have far to look. If they exist, they would probably already be well known to science and closely studied – although their outward manifestations may seem hard satisfactorily to explain.

Inspection suggests a well-known, real-life, set of observable phenomena that would appear at least to approximate to the theoretical specification of keepers: some of the behaviours and mental conditions that a current Western perspective would classify as mental disorders. Some of the characteristic symptoms of what psychiatry diagnoses as depression, alcoholism and other addictions, obsessive compulsive disorders, non-suicidal self-injury, psychoses, and perhaps aspects of other common syndromes might be understood not as dysfunctions but as clusters of protective responses to the suicidogenic potential of emotional pain.

A comprehensive analysis of potential instantiations of keepers across the entirety of psychiatric pathology would be an undertaking beyond this book's scope, but an exploratory start can be made – to assess the hypothesis that some common psychiatric symptoms may function as reactive defences against suicide. Three preliminary points are made. First, excluded from this discussion are developmental disorders such as autism, and organic or degenerative neurocognitive syndromes such as Parkinson's and Alzheimer's diseases, the life stage timing and course of which would suggest them to be unlikely candidates as evolved anti-suicide defences. Second, it would be open to debate whether generalised anxiety disorder (GAD), a frequently diagnosed condition, would be better understood as a likely companion to keeper responses, rather than a type of keeper in itself. As was discussed in the previous chapter (Sect. 4.4.4), protracted anxiousness may be better construed as a prototypical, adaptive, animal response to uncertain fitness threats generally, rather than as a defence against the threat of suicide specifically. With these provisos, common mental disorders are, for current purposes, lumped together and abbreviated as CMDs (Goldberg & Goodyer, 2005): common and mental for sure but, in the context of this discussion, not necessarily disordered.

Third, it is important to be clear about what would and would not constitute evidence of an anti-suicide defence: in particular, if the hypothesis is correct, that phenomenon X is a keeper, then support for that conclusion would, perhaps counterintuitively, *not* be found in statistical findings that X is associated with less

suicidality. The paradox arises from a conflict that may be endemic in evolutionary science, that evolutionary hypotheses are often composite ones, predicting both ancient origin and current effect, components that can rarely be tested separately (Simpson & Campbell, 2005). To take an example,[1] a hypothesis that depression evolved to suppress suicide might arguably be corroborated by a survey that finds people to be at greater risk of suicide when depression lifts – the temporal variance might be taken to demonstrate the anti-suicide protectiveness of depression while the depression held. But the same finding could also be read as counter-evidence, on the grounds that as long as a predictable suicide risk persisted, then the supposedly evolved defence against suicide, if that is what depression is claimed to be, ought to have persisted too. By the same token, if another study found no variances – that the severity of depression correlates in lockstep with suicide risk – then depression's evolved anti-suicide machinery could be said to be working so optimally that its protective functionality was invisible. This kind of epistemological bind occurs elsewhere in evolutionary debates: Sesardic (2005) assesses that correlational testing of a comparable theory, the so-called Westermarck effect – an evolved psychological mechanism said to discourage human inbreeding – has become a zero-sum game, the same evidence being cited on both sides of the argument.

Avoiding this methodological dead end, and in keeping with the forward-engineering approach adopted for this enquiry, a judgement as to whether symptoms of CMDs may or may not constitute evolved keepers probably has to rest instead on whether the entirety of an *a priori* design specification of keepers is so convincingly realised in the observable form of CMDs that the design can be plausibly accepted as CMDs' evolved functionality (Tooby & Cosmides, 1992). Further, this explanation of the aetiology of CMDs would need to be demonstrably better than any other available account (Andrews, Gangestad, & Matthews, 2002). Specifically, it would need to be shown that CMD symptoms, as hypothesised forms of keepers, correspond point by point with the predicted design features listed in Chap. 4 (Fig. 4.3, p. 146). The strength or otherwise of these matches will be discussed in turn in the paragraphs below. None of the observations that follow are based on a formal systematic review of literature; rather, drawing on reviews where found, the aim is to make a preliminary assessment of the consistency between *a priori* design and empirical observation.

Alphabetical references (*a* to *t*) in the following sections cross-refer to the specifications itemised in Fig. 4.1, p. 145.

[1] We are here setting aside the potential circularity that suicidality may itself be taken as a diagnostic criterion for depression and that depression may have lifted due to an artificial, endogenous confound such as the use of antidepressants. Some clinicians and researchers do indeed caution that suicide risk may intensify when depressive symptoms start to lift (Buchholtz-Hansen, Wang, & Kragh-Sørensen, 1993; Meehl, 1973). Others suggest that some suicides among apparently recovering patients may occur, rather, due to a cyclical recurrence of depressive states (Schweizer, Dever, & Clary, 1988; Sharma, Persad, & Kueneman, 1998).

5.1 Pain Input

The keeper model proposes that chronic and intense pain would operate as the primary cue that triggers autonomic anti-suicide responses, subject to the threshold "brain" condition of puberty or early adolescence being reached – this life stage marking the transitional point at which suicide becomes a cognitively available means to escape pain.[2]

(a) *Keepers would be activated by chronic, intense, pain (subject to the developmental condition of a 'brain' input).*

Pain, both physical and psychological, is strongly linked with psychopathology (APA, 2013; Dersh, Polatin, & Gatchel, 2002; Perry, 2017; Tossani, 2013). Dysphoria is a defining feature of some psychiatric diagnoses, such as mood disorders (Berner, Musalek, & Walter, 1987; Starcevic, 2007), and borderline personality disorder (Meares, 2008; Zanarini et al., 1998). Pointing to possible origins of a precipitating misery, onsets of psychiatric syndromes have been found typically, but not always, to occur in within a few weeks of adverse life events or in the wake of major or recurring social problems, and they may be associated with a longer-term "kindling" effect of distal, predisposing adversities in childhood (Brown & Harris, 1989; Goldberg & Goodyer, 2005; Harris, 2000b; Kessler, 2000; Maughan & Collishaw, 2015; Rutter & Sroufe, 2000). The bulk of research in this field relates to onsets of depression and anxiety, and their aetiologies in negative events and conditions (Birley & Goldberg, 2000; Brown & Harris, 1993; Brown, Harris, & Eales, 1993; Harris, 2000a; Kendler, Hettema, Butera, Gardner, & Prescott, 2003; Kendler, Karkowski, & Prescott, 1999): Surtees and Wainwright (2000), for example, identify a marked spike in the odds of an onset of major depression shortly following the loss of a spouse, the odds then decaying rapidly over subsequent years. Emotionally painful life events have also been posited often to precede other categories of diagnoses, including bipolar disorder (Frank, Kupfer, & Malkoff-Schwarz, 2000), schizophrenia (Brown & Birley, 1968; Day, 1989; Varese et al., 2012), alcoholism and other addictions (Gorman & Peters, 1990; Sinha, 2008), bulimia (Welch, Doll, & Fairburn, 1997), and, almost by definition, post-traumatic stress disorder (Breslau et al., 1998). Menninger (1963) recounts how a diversity of mental disorders were apparently precipitated by the flu epidemic of 1918–1920, including many cases of what was then diagnosed as "dementia praecox" – subsequently relabelled schizophrenia. Taken together, this apparently general relationship between preceding life adversities and subsequent CMDs would be consistent with a hypothesis that diverse CMD symptoms may operate as reactive responses to emotional pain.[3]

[2] Many of the citations that follow draw on the pioneering work of medical sociologist George W. Brown and his co-workers in uncovering common psychosocial precursors of common mental disorders and their remissions (Harris, 2000b).

[3] Depression can also precipitate new stresses due to its adverse impact on the sufferer's social supports, with the implied risk of a potentially self-perpetuating downward spiral (Hammen, 1991, 1992).

(b) *Input variable would be the unidimensional aversiveness of pain, regardless of the pain's source or quality.*

Although specific links have emerged in some studies (Kendler et al., 2003; Kessler, 2000; McLaughlin et al., 2012), there appears overall to be little evidence that different varieties of emotional pain, or different types of precipitating event, provoke different types of psychopathological outcomes: rather, psychosocial adversity in general appears to associate with the onset of psychopathology in general (Goldberg & Goodyer, 2005; Harris, 2000a; Kessler et al., 2010). The main dimension of specificity appears linked to the precipitation of anxiety problems by incidents of danger, while depression may be more likely to follow experiences of social losses, although such a parsing may be somewhat artificial because depression and anxiety usually occur anyway in combinations (Cooke & Hole, 1983; Goldberg & Goodyer, 2005). This particular pattern of specificity would not anyway conflict with the hypothesised design of keepers: generalised, protracted anxiousness, to repeat the point, was posited in Chap. 4 (4.4.4) to function not uniquely as an anti-suicide defence but rather as a general animal response to danger. On this basis, anxiousness would be expected to associate with keepers rather than itself to constitute one. The otherwise weak linkage between the type of preceding adversity and type of CMD outcomes would lend support to the notion proposed here that the unitary force of emotional pain, regardless of its type or origins, may act as the organism's proxy measure of suicide risk and the operative input that triggers potentially diverse keeper responses.

(c) *Keeper responses would be calibrated so that the intensity of defensive outputs accords with the intensity and chronicity of the pain input.*

Whether a correlation exists between the intensity of the subjective experience of pain and CMD symptom severity is unclear, and no doubt the associations are complex and multifaceted, particularly as psychological pain is itself among the diagnostic criteria of some disorders (APA, 2013; WHO, 2010). But it is at least suggestive that heightened susceptibility to CMDs is associated with the number and objective severity of preceding adversities – and, presumably, by implication, the intensity of the consequent emotional distress (Goldberg & Goodyer, 2005; Jenkins, Madigan, & Arseneault, 2015; Ormel & Neeleman, 2000). Multiple studies have found the likelihood of mental orders to increase with the number of childhood adversities, although sub-additively, the strength of the association apparently weakens with increasing numbers of incidents (Green, McLaughlin, Berglund, et al., 2010; Kessler et al., 2010; McLaughlin et al., 2012).

5.2 Brain Input

A developmental "brain" condition of cognitive maturity is posited to apply both to suicide risk and to the onset of keeper responses to suicide risk: natural selection would not have detected fitness value, and therefore is unlikely to have favoured, keeper responses before the species-typical life stage at which suicide becomes enactable.

(d) *Keepers would not activate earlier than the species-typical age of first onset of suicide, in early adolescence, possibly signalled by the onset of puberty.*

First onsets of most common CMDs – including major depression and other mood disorders, generalised anxiety, substance abuse disorders, and psychoses – seldom occur before early teenage years (Kessler et al., 2007). This coincidence would be consistent with the notion of CMDs responding in part to the developmental reaching of a cognitive floor of suicide. To observe that those CMDs hypothesised to act as keepers are rare in young children is not to claim that young children are immune from psychopathology: rather, it suggests a possible explanation for the apparent discontinuity in both the nature and the prevalence of early childhood mental disorders compared to those of puberty and beyond. Major depressive disorder, for example, displays not just rarity but a contrasting gender distribution, familial pattern, and clinical course, among pre-pubertal children compared with later onsets, a cluster of differences which may point to pre- and post-pubertal onsets having categorically different aetiologies (Weiss & Garber, 2003; Weissman, Wolk, et al., 1999).

It is not clear why the first onsets of many CMDs occur typically from the early teenage years onward, but the timing may be consistent with a hormonal input associated with puberty, a loose correlate of mental development (Goldberg & Goodyer, 2005), and possibly acting as a proxy signal of the emergence of the intellectual capacity for suicide. Adult-pattern major depressive disorder, and substance abuse disorders, characteristically first appear from age 12 to 13 onward (Angold & Rutter, 1992; Weissman, Wolk, et al., 1999), a timing that would seem to approximate to puberty at least in Western cultures.

5.3 Deactivation

(e) *Keepers would demobilise spontaneously following a reduction in originating pain input.*

As would be expected if CMDs responded to emotional pain in a manner akin to an immune response, CMDs are usually not permanent conditions. In most cases, they lift spontaneously given time and favourable psychosocial conditions, with or without medical interventions, over a period of days, weeks, months, and, occasionally, years (Galanter & Kaskutas, 2008; Goldberg & Goodyer, 2005; Menninger, 1963; Reed, Fitzmaurice, & Zanarini, 2012; Rogers, 1980). Even schizophrenia, a condition widely presumed to be intractable and deteriorating, appears to follow a natural course with most cases eventually significantly improving (Jablensky, 2009). Menninger (1963) notes, for example, the 153 “incurables” who had to be abandoned to their fate in 1940 in a French psychiatric hospital after the staff fled the imminent invasion: traced 4–5 years later, more than a third were found to have re-established themselves in their communities. In general, remissions of CMDs tend to follow reports of an easing of the provoking life situations that preceded them. In this respect, the lifting of mental disorders follows a pattern that mirrors their onsets (Harris, 2000a). Marked improvements in depression and anxiety, for

example, are typically preceded by reductions in life difficulties and positive life events (Brown, 2009). Not any positive event appears to link to a subsequent moderating of symptoms, however, but rather those events that offer hope, a sense of security, or otherwise promise an end to ongoing states of adversity or deprivation (Harris, 2000a; Ormel & Neeleman, 2000).

(f) *Deactivation would usually be slow, gradual and delayed, especially without an unambiguous 'all clear' signal.*

Keepers would be expected to stand down cautiously, in view of the gravity of suicide as a fitness threat, at least in the absence of an definite "all clear." There appears to be little contra-evidence that precipitous remissions from CMDs are common: although rapid spontaneous remissions can occur from addictions following a "fresh start" that is often reported as a spiritual experience (Alcoholics Anonymous, 2001; Galanter, 2008), it may be that a gradual release from CMDs is more the rule. Episodes of depression usually run their course over some 3–6 months (Fox, 2002), although the suddenness of the remission stages is unclear. As perhaps suggestive evidence, the odds of an onset of depression have been found gradually to decay over the years following a severe provoking event, as the individual finds ways to adjust (Surtees & Wainwright, 2000), although this pattern of adjustment to adversity may be driven by other mechanisms than keepers, to be discussed in the next chapter. Other disorders, including borderline personality disorder (Reed et al., 2012) and schizophrenia (Jablensky, 2009), may take several years to remit.

5.4 Specific Types of Keeper Responses

(g) *Responses would aim to limit motivation for suicide (pain-type); or limit the capacity to organise suicide (brain-type).*

Chapter 4 tentatively advanced nine specific mechanisms, summarised in Fig. 4.2 (p. 146), by which keepers might be expected to respond to intense and chronic psychological pain. These responses would either ameliorate the aversiveness of the pain (*pain-type*) by means analogous to known ways in which physical pain can be regulated, or attenuate the individual's cognitive capability to organise a suicidal act (*brain-type*). This section briefly reviews the accordance between these hypothesised responses and clinical and epidemiological observations of CMD symptoms. Roman numeral references in this section (***i*** to ***ix***) cross-refer to Fig. 4.2.

5.4.1 Pain-Type Keepers

(i) *Autonomic numbing of painful (and possibly all) emotions.*

A general deadening of emotions may be found in the depressive states associated with a number of CMD diagnoses, including the "malignant apathy" of psy-

chosis (Jamison, 1999), the "emotional analgesia" of PTSD (Monson, Price, Rodriguez, Ripley, & Warner, 2004), and the emotional detachment of depression, which may be understood to offer a safe refuge from intolerable mental stress (Yufit & Bongar, 1992). Hendin (1975) posits that depression has the effect of inhibiting suicide in part by undermining the motivation: based on clinical case studies of 50 patients, students, he argues that the flat affect and withdrawal of depression constitute an autonomic numbing that may lessen the drive for a suicidal escape. In his words:

> It is said that depression operates to paralyze action and that a lessening depression makes possible an overt, actual suicide attempt. But this is an inadequate explanation for what takes place with these students.
>
> Depression is actually a form of protective deadness which can shield the individual and may even make suicide unnecessary for some. (Hendin 1975, pp. 329–330)

(ii) *Compulsive self-medication with analgesics.*

Alcoholism and other addictions have been interpreted by many clinicians as a compulsive self-medication, a "deliberate dimming" of emotional pain (Murphy, 2000) that averts, or at least defers, actual suicide (Himmelhoch, 1988; Maris, 1991; Wagner, 2009). The notion of protective substance abuse is seminally propounded by Menninger (1938), who classes alcoholism and addiction along with several other self-destructive behaviours that, he asserts, function as sublethal substitutes for wilful self-killing.

The autonomic relief of suicidogenic pain by compulsive substance use, if that is what addiction is, is not fail-safe or cost-free, and it involves a trade-off of lethal risks that may be central to an understanding of the phenomenon (Ali et al., 2013). While alcohol abuse, for example, is known to associate with suicidality, it is not known how many incidents of drunkenness prevent suicides relative to how many precipitate suicides (Hufford, 2001; Tousignant, 2003). Many alcoholics themselves might concur with Menninger's (1938) clinical view that those alcoholics who take their own lives do so in spite of, rather than primarily because of, their intoxication. Drug and alcohol addicts often report that, while admittedly introducing new hazards, their compulsions constituted more a solution than a problem: therapists working in the field commonly hear ambivalent confessions along the lines of "The drugs served me well for a long time" and "The drink saved my life" (Seeburger, 2013; Thompson, 2013). Recovering addicts will often confide that their primary problem, which compulsive substance use provisionally addressed, was that life itself had become unmanageable (Galanter & Kaskutas, 2008).

(iii) *Pain offset relief: compulsive self-administration of other pain.*

Compulsive non-suicidal self-injury can be interpreted, perhaps paradoxically, as the regulation of psychological pain by use of the neurological phenomenon of pain offset relief (Moont, Pud, Sprecher, Sharvit, & Yarnitsky, 2010). It is well documented that emotional pain can be alleviated by measured self-injury (Biro, 2010; Joiner, 2005; Shneidman, 1996; Tossani, 2013), and there are research findings to suggest that to relieve negative affect is usually the behaviour's primary function

(Chapman, Gratz, & Brown, 2006; Heilbron, Franklin, Guerry, & Prinstein, 2014; Klonsky, 2007, 2009). People who cut or burn themselves sometimes explicitly report it to be a means of keeping otherwise unbearable psychological pain within survivable limits (Cameron, 2012; Linehan, 1993; A. Reeves, 2010), on which basis self-harm may be regarded not, as is often assumed, as a step along the path to suicide but as a sublethal alternative (Menninger, 1938; Simpson, 1976).

(iv) *Distract from pain: preoccupations, possibly unrelated to the pain source.*

Anti-suicide functionality, operating to distract the individual from pain that might otherwise induce wilful self-killing, may underlie the many and sundry obsessive cognitive states and compulsive behaviours that characterise several CMD diagnoses. These may include eating disorders and food cravings, which often accompany depression and the manic states observed in bipolar depression (Himmelhoch, 1988). With regard to behavioural and substance addictions, research by Hirschman (1992) finds that the overriding, compulsive preoccupation with acquiring and using addictive substances may carry a comparable upside, as such states are often experienced by addicts as providing a positive, orderly focus for their lives.[4]

(v) *Detach from unbearably painful reality: break "doxastic sheer pin"*

The delusions – auditory, paranoid, and others – that characterise psychoses may offer potentially life-saving epistemic benefits, because they may provide the individual with, in effect, a less painful alternative reality to inhabit (Antrobus & Bortolotti, 2016; Gilbert, 1998; Hundert, 1992; Laing, 1960, 1967; Roberts, 1991, 1992; Schwartz & Wiggins, 1992). Perhaps for this reason, delusions and hallucinations have been linked with a reduced risk of suicide in certain high-risk populations (Hawton, Sutton, Haw, Sinclair, & Deeks, 2005; McGirr, Paris, Lesage, Renaud, & Turecki, 2009). Offering an account of the function of this class of symptoms, Laing (1967, p. 38) describes psychosis as "…a special strategy that a person invents in order to live in an unliveable situation." Laing is not explicit about what else a person would do if he cannot or will not "live in an unlivable situation," but the potential for suicide seems to be implicit. On this basis, there would be logic to the idea that a fitness threat of suicide may provide a biological impetus for a protective, psychotic response. Bolton and Hill (1996) argue that, to function healthily, perhaps to function at all, all humans must sustain certain basic requirements for meaning: we need to know that the world is predictable enough, that it can be relied upon to meet our individual needs, and that we as individuals are competent enough to live

[4] Commensurately, once an adequate alternative primary purpose in life is found, often involving a religious conversion or spiritual experience (Jung, 1961; Menninger, 1938), the compulsion to use drugs or drink often lifts, along with other addictive behaviours, in a spontaneous remission that can appear miraculous (Galanter & Kaskutas, 2008; Pearce, Rivinoja, & Koenig, 2008; Zemore, 2008). If addiction were understood as a reactive defence against suicidogenic pain, then such a recovery pattern could make sense: once the originating pain is relieved, an organismic defence against suicide would presumably become redundant.

in it. In extreme conditions, delusions might be understood to create this vital, life-preserving meaning (Antrobus & Bortolotti, 2016; Gilbert, 1998),

(vi) *Make sense of the pain: invent a narrative to explain its existence.*

As a related possibility, given that physical pain tends to be easier to bear if some cause for it is perceived (Eccleston, 2001), emotional pain might also be made more tolerable if the sufferer has a plausible rationale for its existence, real or manufactured. Hundert (1992), illustrating Semrad's (1973) assessment of psychosis as "the sacrifice of reality to preserve life," provides a case study demonstrating how such a protection might work. He describes a troubled patient with a history of multiple suicide attempts: following these, the patient acquired a system of delusions centred on the belief that he was Adolf Hitler, re-incarnated to suffer in penance for his war crimes. According to Hundert's (1992) assessment, this delusional framework provided the patient with an organising rationale for his continued painful existence, supplanting a reality where suicide was otherwise his only option.

(vii) *Find a reason to live with pain: possibly illusory or delusional.*

To suggest another possible anti-suicide property of delusions, they may provide the individual with the necessary compelling motivation to soldier on, in spite of intense pain (McGirr et al., 2009; Paris, Nowlis, & Brown, 1989; Roberts, 1991). The absence of such motivation may invite the despairing "What's the point of carrying on?" doubts found in various forms in many, perhaps most, suicide notes (Reeves, 2010). Delusional belief systems may offer vital reasons for living, at least among some high-risk groups: Mitchell and Roberts (2009) found that some schizophrenic patients viewed the prospect of being relieved of their delusions as an existential threat – fearing that, without their delusions, they would be left with "nothing to live for."

5.4.2 Potential Multiple Functionalities of Delusions

The above three observations (***v, vi, vii***) sum to a tentative proposal that psychotic delusions may fulfil a complex anti-suicide functionality: they may provide less painful realities to inhabit, acceptable explanations for the experiencing of pain, and motivation for the individual to continue to endure pain. The hypothesised common design objective would be to lessen the individual's motivation to seek escape from what could otherwise be a dangerously suicidogenic affective experience. Delusions might be understood as a life-preserving, protective withdrawal, a severing of connections with society and the rest of the real world, into a refuge that is relatively safe from unbearable life stressors (Farberow, Shneidman, & Leonard, 1961; Yufit & Bongar, 1992). It may at least be suggestive that a survey found patients who "recovered" from their delusions to be markedly more suicidal than those who remain chronically deluded (Roberts, 1991). As an aside, although often taken to be the hallmark of psychoses, the phenomenon of delusions may be widely

concomitant with other psychopathological states (Baethge et al., 2005): this apparently broad instantiation could point to delusions as a type of keeper that often mobilises alongside others, designed to protect people in enough emotional pain to be at risk of taking their own lives.

5.4.3 Brain-Type Keepers

Alongside pain-type keepers, which operate to erode the motivation for suicide, a conceptually distinct class of brain-type keepers, reviewed next, would expectably interfere with the individual's intellectual capacity to plan and enact a suicidal endeavour.

(viii) *Degrade cognitive ability to plan and enact tasks.*

Depression and certain other CMDs may be characterised by a depletion of high-level cognitive functioning sufficient to disrupt the individual's capacity to organise an effective suicide attempt. The impairments appear to be selective: depression is associated with a denial of mental processing resources through a flooding of systems with irrelevant, useless information (Gohier et al., 2009) and a downgrading of processing speeds, executive functions, and certain aspects of memory, which together degrade the individual's ability to plan and undertake complex tasks (McDermott & Ebmeier, 2009). Such specificity would be consistent with the idea that, in response to intense and chronic pain, the human organism may, as an emergency anti-suicide measure, tactically suppress its own capability to plan and organise complicated projects while sustaining enough general cognitive functioning to permit survival.

Autonomic cognitive impairments have specifically been linked to a protection against suicide in high-risk groups. A reduced ability to concentrate has been found to correlate with less suicidality among schizophrenics (Hawton et al., 2005; McGirr & Turecki, 2011), and deficits in concentration and decisiveness may also protect depressives (McGirr et al., 2007). Why these associations should occur is unclear, and they may anyway be evidentially ambiguous for the purpose of this enquiry, but it would make intuitive sense that a certain level of intellectual impairment may be protective for those at suicide risk (Maris, 1991; McGirr et al., 2007).

Possibly commensurate with the notion that some depressive symptoms confer an evolved, biological protection against suicide, there is considerable, although not unchallenged, evidence that, among young people, antidepressants can cause an increased risk of suicide (Demyttenaere, Desaiah, Raskin, Cairns, & Brecht, 2014; Jick, Kaye, & Jick, 2004; Maris, 2015; Reeves & Ladner, 2010).

(ix) *Loss of psychomotor energy.*

Gilbert and Allan (1998) argue that depression may be understood as an instinctual paralysis, an involuntary demobilisation that points to its likely evolutionary

origins in the avoidance of fitness dangers that would arise from action. Suicide would arguably constitute an extreme fitness danger, against which the loss of energy characteristic of depression, and of the depressive states of other CMDs, could be understood as a logical and effective protective response: "The meekness of depression could hardly imagine suicide" is one sufferer's report (Solomon, 2014, p. 282). Fatigue has been found to be more characteristic of non-suicidal depressives and schizophrenics, compared with suicidal controls, an association that may point to a protective effect (Hawton et al., 2005; McGirr et al., 2007; McGirr & Turecki, 2011).[5]

As an overview, this analysis accords with Menninger's (1963) assertion that multiple types of mental disorder are essentially the same condition, qualitatively identical and vary only quantitatively, despite their diverse outward forms and sundry labels. They all have, he argues, the same life-preserving, salvage function. The specific proposal being made here is that some CMDs may be understood not as discrete disorders but as commonly occurring constellations of pain-type keepers (reducing the aversive motivation) and brain-type keepers (restricting the intellectual means). As an indicative illustration of this clustering, Fig. 5.1 attempts to map the nine hypothesised types of keepers, as suggested in Fig. 4.2 (p. 146) and elaborated above, against some of the main diagnostic criteria of range of common psychopathologies. According to this conception, most CMDs could be credited with combining elements of both pain-type and brain-type defences. Non-suicidal self-injury (NSSI) appears as an exception to this pattern – NSSI may downregulate the experience of emotional pain but without explicit measures to make suicide more difficult to do: but then, NSSI routinely co-occurs with other CMDs which could serve a brain-type function under another diagnostic label. The worry, rumination, restlessness, and insomnia of generalised anxiety disorder may be understood not as an alleviation of emotional pain *per se* but as a manifestation of the organism's urgent attempt to find or select some meaning that would produce that alleviation and/or to address the root cause of the emotional distress.

Figure 5.1 is meant as a tentative presentation: there may turn out to be more or fewer than nine types of keepers, and they might be mapped against CMDs in other formulations. Nonetheless, the schematic suggests that, in principle, diverse CMD symptoms could plausibly match the affective and behavioural outcomes expected of a system of anti-suicide defences.

[5] Ferrada-Noli, Asberg, Ormstad, Lundin, and Sundbom (1998) found that, among 117 traumatised refugees, those without symptoms of depression reported more suicide attempts than those with. The finding was only on the margins of statistical significance and would, anyway, provide only ambiguous evidence in support of the hypothesis of this chapter. As cautioned earlier, correlational associations that may be taken to suggest an anti-suicide effect in certain traits could, at the same time, be taken as counter-evidence, that those traits did not evolve for a special anti-suicide purpose.

Suggested types of keeper anti-suicide mechanism (see Chapter 4)	**Diagnostic criteria of some common psychopathologies** (APA, 2013)						
	Major Depressive Disorder	**Substance use disorders**	**Generalised Anxiety Disorder** (GAD) [a]	**Non-suicidal self-injury** (NSSI) [b]	**Psychotic disorders**	**OCD**	**Bipolar disorders**
PAIN-TYPE (weaken the motivation for suicide) *(i) Autonomic numbing.* *(ii) Medicate the pain.* *(iii) Pain offset relief.* *(iv) Distract from pain.* *(v) Detach from pain.* *(vi) Make sense of the pain.* *(vii) Find reason to live with pain.*	• Feeling 'empty'; 'Having no feelings'; 'Not caring any more' *(i)* • Craving foods *(iv)*	• Compulsive use of analgesics and other mind-altering substances *(ii, iv, v, vi, vii)*	• Worry, rumination restlessness; insomnia *(vi, vii)*	• Self-injury *(iii, iv)*	• Diminished emotional expression *(i)* • Delusions; hallucinations *(iv, v, vi, vii)*	• Obsessions; compulsions *(iv, v, vii)*	• Depressive episode *(i)* • Manic/ hypomanic episodes *(iv, vii)*
BRAIN-TYPE (restrict access to the means of suicide) *(viii) Degrade ability to plan and enact tasks.* *(ix) Loss of psychomotor energy.*	• Indecisiveness; diminished ability to think or concentrate *(viii)* • Loss of interest in activities; fatigue, loss of energy, hypersomnia; psychomotor retardation; loss of appetite *(ix)*	• Compulsive use of sedatives *(viii, ix)*	• Difficulty concentrating; mind going blank *(viii)* • Fatigue *(ix)*		• Disorganised thinking; Disorganised/ abnormal motor behaviour *(viii)* • Negative symptoms; catatonia *(ix)*	• Obsessions (viii); • Compulsions *(ix)*	• Depressive episode *(viii, ix)*

Fig. 5.1 A tentative mapping of hypothesised types of anti-suicide mechanisms (keepers) across common diagnostic categories of mental disorder. (All but one of the mental disorders shown here could arguably manifest both of the posited twin strategies of keepers – to weaken the impetus towards a suicidal escape (pain type) and to impair the capacity to undertake a suicidal venture (brain type)

[a]The anxiousness of generalised anxiety disorder may be better understood as a concomitant of keepers rather than a keeper defence in itself, but the pain-type function of GAD posited here might be taken to express the urgency of the organism's need to seek relief from suicidogenic pain

[b]Non-suicidal self-injury (NSSI), classified as a "condition for further study" in DSM-5 (APA, 2013), appears here as an exception, arguably lacking a "brain-type" action: this function may be provided instead by other CMDs often comorbid with NSSI)

5.5 General Characteristics of Keeper Responses

(h) *Keepers would drive compulsive and involuntary behaviours, resisting conscious awareness and intervention.*

As would be expected of an autonomic system designed to protect the organism against as grave a fitness threat as self-killing, the symptoms of CMDs, construed as clusters of keepers, are not easily malleable – they resist direct, conscious moderation (LeDoux, 1996; Westen, Novotny, & Thompson-Brenner, 2004). Many symptoms, such as addictions, delusions, and compulsive self-harm, are characterised by a lack of personal self-awareness (Oltmanns & Powers, 2012). Alcoholism, for example, is understood to be a product of the reptile brain; that is, beyond the reach of high-level cognitive intervention or insight (Vaillant, 2013). That an alcoholic does not know, at least at the time, what impels him to drink or why leads Menninger (1938) to suggest the behaviour has counterparts in animal psychology – the ethological idea of fixed action patterns, triggered by innate releasing mechanisms. Psychotic delusions would by definition match keeper design requirement for instinct blindness – delusion being a "false belief based on incorrect inference about external reality that is firmly sustained despite what almost everyone else believes and despite what constitutes incontrovertible and obvious proof or evidence to the contrary" (APA, 2013, p. 819). Since, as Storr (1960, p. 5) argues, a person's life may be tolerable only on account of his or her delusions, it may be understandable that they resist "all the assaults of reason." The falsity of the beliefs that would expectably associate with keepers – misbeliefs that might provide the required means to stay detached from painful reality, rationales for experiencing of pain, and/or reasons to carry on living in spite of pain – would presumably need to be largely imperceptible to conscious awareness in order for those beliefs convincingly to fulfil an anti-suicide function.

(i) *Multiple forms of keepers are likely to operate in an integrated fashion in the same individual, concurrently and/or temporally.*

It is possible, as Chap. 4 suggested (4.5), to intuit numerous ways in which keepers could either weaken the motivation to escape pain, or interfere with the mentalising required to enact suicide or a combination of both. Multifarious forms of keeper could therefore be viewed as functionally equivalent – provoked by the same input (emotional pain, as a proxy indicator of suicide risk) and designed to fulfil the same objective (to forestall suicide). If some symptoms of CMDs are manifestations of keepers, then diverse combinations of symptoms (any, say, from Fig 5.1) could be expected to instantiate in between those unifying start and end points to form an integrated, systemic response.

This hypothesised shared functionality of CMDs/keepers would tally with the extreme comorbidity that characterises psychopathology. CMDs are not discrete entities, as infections and other physiological pathologies are generally understood to be. There are few natural boundaries between diagnostic criteria in psychiatry and few "zones of rarity" where diagnoses do not overlap (APA, 2013). Even allowing

for diagnostic overlaps, it may be more the rule than the exception for multiple CMDs to co-occur in the same individual (Angold, Costello, & Erkanli, 1999; First & Pincus, 2009; Kessler, Chiu, Demler, & Walters, 2005; Westen et al., 2004). Some combinations – for example, anxiety and depression, and depression and addiction – are particularly commonplace (Goldberg & Goodyer, 2005; Rosenthal, 2003), but there is no neat pattern of pairings: Newman, Moffitt, Caspi, and Silva (1998) find that half of comorbid cases meet the criteria for three, four, or even more disorders. The comorbidity of CMDs is observed temporally as well as concurrently: multiple disorders routinely occur in the same individual at different times of life (APA, 2013; Kendler, Davis, & Kessler, 1997; Kessler et al., 1994). One inference to be drawn from this patterned co-occurrence is that outwardly divergent CMD symptoms may share underlying causal roots, an idea supported by a number of non-specific features of psychopathology that are otherwise hard to explain (Anderzhanova, Kirmeier, & Wotjak, 2017; Durisko, Mulsant, McKenzie, & Andrews, 2016; First & Pincus, 2009). There is a signal lack of treatment specificity – the same drugs are claimed to alleviate both alcoholism and depression, for example (Agyapong, 2013). The same correlational biological traits are found across CMD diagnoses – such as an impulsivity related to a history of childhood adversity and HPA/adrenergic/serotonin abnormalities (Fawcett, 2012). Similar provoking life events figure in the onsets and remissions of different CMDs (Eales, 2000). No specific biomarker has yet been found that distinguishes any diagnostic category (Charney et al., 2002). The genetic vulnerabilities to different diagnoses overlap (Gratten, Wray, Keller, & Visscher, 2014). Universal cognitive processes have been found to cut across diagnostic lines (Fairburn, Cooper, & Shafran, 2003; Harvey, 2004). Some disorders appear to be functionally interchangeable: Hirschman (1992) finds that, among addicts, virtually any relief will do for the purpose of escaping mental pain, with the outcome that if one substance is denied, another substance, or even behavioural addictions such as compulsive sex or gambling, will be substituted in its place.[6]

This is not to suggest that CMDs are entirely homogenous in their causes – individuals may vary in their susceptibilities to certain clusters of CMDs (i.e., by this book's conceptualisation, certain clusters of keepers), according to age, gender, genetic factors, environmental and developmental backgrounds, personality, and other aspects of individual difference (Arsenault-Lapierre, Kim, & Turecki, 2004; Goldberg & Goodyer, 2005; Kendler et al., 1997; Krueger & Tackett, 2006; Nettle, 2006). Rather, the conclusion reached by many researchers is that a susceptibility to CMDs generally may be underlain by a unitary, latent continuum of psychological distress (Caspi et al., 2014; Lahey, Krueger, Rathouz, Waldman, & Zald, 2017; Mueser, Drake, & Wallach, 1998; Stochl et al., 2015). A so-called "p" factor appears to prevail, indicating an individual's general psychiatric vulnerability, conceptually analogous to the "g" factor familiar in psychology as an overarching index of general intelligence (Caspi et al., 2014). The "p" factor consolidates even the highest-level

[6] This commonality across addictions is mirrored in the universality of suicide risk: addiction to apparently any drug is linked to heightened suicidality (Tousignant, 2003), and there is no evidence that some drugs are more linked to suicide than others (Lester, 1992).

observed clustering of comorbidities, in particular the broad dichotomy between internalising disorders (e.g., depressive, anxious symptoms) and externalising disorders (e.g., antisocial behaviours, substance addictions) (Achenbach & Edelbrock, 1981; Kendler et al., 1997). Differing predispositions to particular syndromes are apparently influenced by personal factors, such as gender and personality types; for example, females and introverts may be disproportionately susceptible to internalising disorders, and males and extroverts to externalising disorders (Kendler et al., 1997). But these branching variations may be best understood as reflecting the way gendered personality styles can diversely express and emanate from a unitary root (Caspi et al., 2014). Linking to this idea, the proposal offered here is that suicide risk, and the organism's aggregate effort to control that risk, expressed flexibly to accommodate individual differences, may provide a basis for understanding the evolutionary origin of a unifying continuum of psychopathology. In effect, the "p" factor may, indirectly via the organism's protective responses, reflect the individual's experience of psychological pain and, hence, suicide risk. The worse the individual's difficulties in dealing with the internal, social, and external environment, and the more aversive the accumulation of adversities, the more likely the individual will suffer potentially suicidogenic psychache and the activation of keeper defences, manifest in a diversity of psychopathological symptoms.

Interlinked evolutionary processes along these lines may serve to elucidate the overlapping heritabilities of suicidality and mental disorders. Both suicide risk and a vulnerability to CMDs appear to run in families, only partially independently (Lin & Tsai, 2016; Uher, 2009). As was outlined in Chapter 2 (2.1), Keller and Miller (2006) argue that the most likely explanation for the maintenance of harmful, heritable mental disorders in human populations, transferring across generations, is that a state of mutation-selection balance prevails: many random genetic mutations, each having a minimally harmful effect on fitness, will be passed to offspring, each mutation eventually to be eliminated by natural selection but only as rapidly as new mutations take their place. An unresolved question raised in Chap. 2 is why random genetic inputs should coalesce into the patterned specific outcome of suicide as opposed to any other behaviour. Indeed, there is the unexplained specificity of psychiatric symptoms also to consider (Gangestad & Yeo, 2006; Polimeni, 2006): by definition, mental disorders are far from random behaviours – their diagnostic criteria reflect commonly observed collections of symptoms as decided by a clinical consensus (APA, 2013). Why would random genetic processes produce a canalised outcome in the form of these characteristic symptoms? To hypothesise a resolution to this puzzle, based on the interim findings of this study, it may be suggested that the aggregate of sundry genetic mutations creates a heritable variability in general life adversity. The canalisation of outcomes from this variability may arise because life adversity of any description can be presumed to cast a unidimensional shadow in the experiencing of emotional pain – life being more or less difficult, and therefore more or less painful, and therefore more or less prone to suicide. By this causal route, much of the heritability of both suicidality, and the CMDs/keepers postulated to mobilise to moderate suicidality, would logically follow in the wake of the heritable component of diverse psychosocial problems in living – whether the inheritance is transmitted genetically or by shared upbringing.

(j) *Keepers are likely to be accompanied by protracted anxiousness, and rumination focused on emotional pain.*

A protracted anxiousness might expectably associate with the activation of keepers on account of the uncertainty and gravity of the fitness threat that suicide poses, as was discussed in Chap. 4 (4.4.4, p. 137). When faced with a potential severe danger that is not sufficiently locatable safely to flee, humans, as animals generally do, may be expected to attend concertedly to the potential hazard and remain on alert with a view to acquiring enough information to decide on a course of action (Blanchard, Griebel, Pobbe, & Blanchard, 2011; Eilam, Izhar, & Mort, 2011). As a species-specific elaboration of this prototypical animal response to uncertain danger, humans appear additionally to engage in repetitive, compulsive, worrying, and mental rumination (Blanchard, Hynd, Minke, Minemoto, & Blanchard, 2001). Intuition suggests that suicide risk would logically call for such a style of response: because the danger comes from within, there is nowhere to run.

Consistent with this expected feature of keepers, free-floating anxiousness occurs widely alongside CMDs. Most cases of major depression, the most common of psychopathologies, are accompanied by a diagnosable anxiety disorder (Kessler et al., 2003), and most people with anxiety disorders also have other diagnosable psychiatric conditions (Kroenke, Spitzer, Williams, Monahan, & Löwe, 2007). Some degree of anxiousness may be viewed as part of a non-specific common core of symptoms that characterise CMDs in general and is a particularly common attendant to the cluster of internalising disorders that mainly affect the individual's inner experience (Goldberg & Goodyer, 2005; Kendler et al., 1997).

As was suggested earlier in this chapter, the specification of keepers would not necessarily view anxiety as a specific anti-suicide response *per se*: anxiety may, rather, constitute a general response tendency to detected, but unlocatable, fitness threats, of which suicide is one – and an extreme one. Worry rumination, and other diagnostic criteria of generalised anxiety disorder (APA, 2013), might nonetheless logically integrate within a scheme of pain-type keepers, as suggested in Fig. 5.1 (p. 166), if they were understood as signalling an autonomic bid to relieve suicidogenic pain – by inducing an urgent search for an anodyne explanation or other resolution for the pain (vi) and/or for reasons to continue living with the pain (vii). Perhaps illustrating the latter, and noting a possibly protective outcome of generalised anxiety, Gureje et al. (2012) speculate that anxious rumination and worry may have the effect of deterring individuals from acting out on suicidal plans due to concerns about the negative consequences of the act for others.

5.6 Trade-Off Considerations

(k) *The compromise objective would be to minimise the risk of suicide, while limiting the imposition of new, potentially drastic, fitness costs arising from the activated keeper.*

Chapter 4 argued that autonomic suicide prevention among those experiencing psychache would involve a trading off of fitness costs: the organism would seek to reduce suicide risk but at the concomitant expense of novel iatrogenic impairments arising from the protective interventions themselves. These trade-off impairments may be significant because a severe threat warrants a severe response. The observable outcomes of CMDs in terms of a linkage between onsets, fitness costs, and suicidality could be understood in the light of this hypothesised trade-off, although an understanding may call for a counterintuitive interpretation of the epidemiological associations. People suffering from almost any CMD tend to have shorter life expectancies and fewer offspring than people without CMDs (Chesney, Goodwin, & Fazel, 2014; Harris & Barraclough, 1998; Keller & Miller, 2006). All-cause mortality rates are significantly worsened for those with, for example, unipolar depression (80% higher than the general population), schizophrenia (160%), and anorexia nervosa (620%) (Uher, 2009). Fertility, measured in births, is commensurately lower, at 90% of the normal rate among those with unipolar depression, 40% for schizophrenia, and just 33% for anorexia (Uher, 2009). Almost all CMDs are at the same time associated with strikingly heightened rates of suicide, for example, 20 times that of the general population for major depression, 8 times for schizophrenia, and 23 times for anorexia (Harris & Barraclough, 1997).

This general association between psychopathology, fitness loss, and suicide, calls for a general explanation, but one has yet to surface that attracts widespread support (Mishara & Chagnon, 2016). Indeed, the few general evolutionary theories of psychopathology currently in circulation largely or completely ignore suicide (Bracha, 2006; Crespi & Badcock, 2008; Del Giudice, 2014; Keller & Miller, 2006; Uher, 2009). A linkage between CMDs, fertility loss, and suicide would however be explicable if CMDs/keepers were understood successfully to be balancing fitness costs – partially offsetting what would otherwise have been an even higher risk of suicide, albeit at the expense of an attenuated fertility. While it is tempting to blame CMDs for the suicides that follow onsets of CMDs, this is to commit the *post hoc* fallacy – to assume that because X followed Y, X was caused by Y (Damer, 2013). The suicides that are associated with CMDs (i.e., most of them) may be better understood as occurring despite the CMDs, not in most cases because of them – in the same way that deaths by infection are not so much caused by, but rather happen in spite of, the body's immune responses. Completed suicides may represent the irreducible residue left after CMDs have successfully kept nearly all of those in danger alive.

The invisible success of keepers is arguably that the vast majority of people with CMDs, despite their mental distress, do not suicide (Ellis & Goldston, 2012; Goldsmith, Pellmar, Kleinman, & Bunney, 2002), and for the most part, their survival and reproductive prospects appear to remain at least partially intact (Uher, 2009). If this interpretation is correct, the success of CMDs/keepers in suppressing suicides will be inscrutable because no salient epidemiological comparison group exists against which directly to demonstrate what the suicide outcome would be, *ceteris paribus*, without their activation. Two outright disproofs might be available, however: the first would be if keepers, expressed as CMDs symptoms, were discovered in any sizeable group, as conceptually they might, to have no effect on, or

positively to promote, life expectancies and reproduction compared to the general population.[7] A second disproof would arise if any CMDs were found to be associated with less, not more, suicidality – a pattern found, as would be expected under a "pain and brain" model of suicide's evolved origins, only for severe intellectual disability and developmental retardation (Harris & Barraclough, 1997; Tanney, 1992) (see 3.2.5).

(l) *Keepers would trigger sensitively, with a high incidence of false alarms – many affected individuals will not have considered suicide.*

Many, but not all, sufferers of CMDs appear to have recent thoughts of suicide – 63%, according to a survey of patients with depression and substance use disorders (Handley et al., 2016). Interpreted through the lens of CMDs as keepers, this finding suggests that CMDs may work well to identify people at risk – the rate of current suicidal ideation associated with CMDs being markedly higher even than the 10–18% cumulative lifetime prevalence found in the general population (Weissman, Bland, et al., 1999). But it also suggests that CMDs successfully identify those at risk at the expense of drawing many false positives into the net – perhaps a third of those caught up in CMDs/keepers may not even be considering suicide. On this basis, CMDs, as keepers, would seem to tolerate a high rate of false alarms. Oversensitivity would be an understandable response tendency in view of the asymmetrical cost of errors involved; the fitness cost of keepers failing to activate when they should (death by suicide) is much more severe than the cost of activating when they need not (a partial loss of fertility arising from the onset of keepers).

(m) *Keepers may themselves become pathological.*

It may seem superfluous to discuss CMDs' potential for becoming pathological given that a psychiatric paradigm views them as pathological by definition. Nonetheless a specific concept of pathology arises from the model proposed: if CMD symptoms were understood as autonomic defences, operating akin to the physiological immune system, then occasional malfunctions would be expected, and perhaps to the extent of themselves causing fatalities. Aligned with the suggestion of this study, and taking a non-conventional stance from within psychiatry, Himmelhoch (1988) advances that a variety of psychiatric phenomena – manic elation, character disorders, self-cutting, addictions, and others – may be construed as evolved restraints, complex systems operating by homeostasis or homeorhesis to keep the organism away from dangerously dysphoric states, and he goes on to argue that these systems may themselves become pathological. Suicide being a severe fitness hazard, warranting commensurately drastic and complex countermeasures, the occasionally lethal system failure may be tolerated as a risk worth taking. The harmful dysfunctionality

[7] One exception to this prospectus might be generalised anxiety disorder, on the grounds that free-floating anxiousness is hypothesised not to constitute a keeper *per se* but likely to accompany the activation of keepers as a general form of protective vigilance in the face of a severe, uncertain fitness threat (see 4.4.4). Bateson, Brilot, and Nettle (2011) argue, citing epidemiological evidence, that dispositional anxiety has a protective effect, associated with lower mortality than controls.

of CMDs (Wakefield, 1992, 2005), by this interpretation, does not reside intrinsically in CMDs, nor even in the suicides that CMDs, when functioning normally as keepers, fail to prevent – keepers would not be expected to achieve a complete elimination of suicide in any event. Harmful dysfunctionality would occur, rather, where CMDs fail to mobilise when they should do and/or where they malfunction to the extent that they themselves become pathological – a fatal self-cutting or drug overdose perhaps – comparable to an autoimmune disease in which the body's immune system attacks healthy cells. A circular pain-breeding-pain dysfunctionality might be observed in the potential for depression, for example, not only to be precipitated by stressful life events but sometimes to precipitate more stress of its own through the damage wrought on the individual's social relations (Hammen, 1991, 1992).

5.7 Manifestations of Successful Operation

(n) *Keepers would result in a low, but above-zero, incidence of suicide in human populations.*

As was argued above (k), although CMDs are characterised by substantially increased risks of suicide compared to the general population, their success in forestalling suicide may arguably be demonstrated in the result that, in spite of sufferers experiencing potentially suicidogenic emotional pain, only very few people with CMDs go on to take their own lives (Ellis & Goldston, 2012; Goldsmith et al., 2002). An efficacious outcome could be viewed from a wider perspective, given, as Chap. 3 argued, virtually all mature humans could suicide, but only 1.4% do (WHO, 2014). If the evolutionary analysis of suicide proposed here is correct, at least part of that global rate will comprise an irreducible species-typical minimum – a natural or base rate of suicide that applies to human populations generally (Andrés & Halicioglu, 2011; Yang & Lester, 1991, 2009). This rate would be irreducible because evolved processes could improve upon it only at the expense of a greater statistical loss of fitness from the further autonomic interventions that would be required to achieve the incremental gain.

(o) *The residual suicides would be intrinsically unpredictable at the level of the organism.*

With a lack of patterning consistent with the expectation that natural selection would have made best use of whatever actuarial cues are available to the organism for predicting and preventing self-killing, no set of risk factors has yet been found that usefully predicts suicides (Chang et al., 2016; Goldney, 2005; Haney et al., 2012; Hawgood & De Leo, 2016; Neuringer, 1974; Tucker, Crowley, Davidson, & Gutierrez, 2015), even among high-risk psychiatric groups, and despite many decades of intensive search (Carter et al., 2017; Goldstein, Black, Nasrallah, & Winokur, 1991; Large et al., 2016; Mulder, Newton-Howes, & Coid, 2016; Murray & Devitt, 2017).

Much of suicidology's hopes appear to be pinned on research in genetics and neuroscience, that such technologies may lead to clinically useful predictive biomarkers being found (Fiori, Ernst, & Turecki, 2014; Lin & Tsai, 2016). The evolutionary model proposed here would predict that optimism in this regard may be misplaced – that a search for utilizable risk factors has only minimal prospects of success and that research resources may be better invested elsewhere. Progress does seem to be very slow. There is no evidence that suicide generally can usefully be understood as a genetic or biological abnormality; the potential genetic markers discovered so far, for example, have been found to have little predictive power and have resisted replication (Bondy, Buettner, & Zill, 2006; Calati et al., 2014; Guintivano et al., 2014; Mullins et al., 2014; Zai et al., 2015). The matter will be discussed further in the closing chapter, but the general point to make at this stage is that mankind's failure to identify biological markers, or any other factors for that matter, that can usefully predict suicide may be judged not so much as a failure on the part of the research effort but as signalling the success of evolution by natural selection in already protecting those at risk. Keeper devices, it is hypothesised, would have been strongly favoured by natural selection through the course of human evolution, to the point that all usefully predictive cues available to the organism will already have been identified and exhausted. Keeper defences would be expected to intervene to protect those in identifiable danger as far as is possible, within a trade-off of fitness costs: more suicides might theoretically be stopped by natural defences but only at the greater fitness cost of imposing onerous impairments on non-suicidal false positives. The suicides that evade the organism's evolved defences would be intrinsically the hardest for the organism to pre-empt and thus comparable to many natural processes: not completely random but effectively unpredictable (Kauffman, 1993; Stelmachers & Sherman, 1992).

(p) *Activated keepers would be associated with suicide, but only inasmuch as they associate with suicidal ideation rather than with the enacting of those ideas. Most suicides would expectably be accompanied by activated keepers.*

As would be expected of CMDs as a hypothesised system of keeper interventions, many or most actual suicides show symptoms of CMDs at the time of death (Arsenault-Lapierre et al., 2004; Bertolote & Fleischmann, 2002; Bertolote, Fleischmann, De Leo, & Wasserman, 2004; Cavanagh, Carson, Sharpe, & Lawrie, 2003; Overholser, Braden, & Dieter, 2012), although the reported association may be weaker in non-western cultures (Hvistendahl, 2012). The few suicides that occur without reports of diagnosable CMDs may well have had psychiatric conditions that either went undetected – compulsive gambling, for example (Ernst et al., 2004) – or were present at a subclinical level (Joo, Hwang, & Gallo, 2016). Interpreted through the theoretical framework of keepers, these suicides can be understood as incidents where defences had correctly mobilised in response to the organism's risk assessment but had failed nonetheless to prevent a suicide outcome. These suicides may constitute the base level of statistical risk that natural selection could not further reduce due to the greater marginal fitness cost that (even) more drastic or (even) more sensitively triggered keeper protections would exact, in terms of a degraded

affective and cognitive functioning in contingencies where suicide would not have happened anyway.

In this light, it is explicable that CMDs correlate strongly with suicidal ideas but not, or only weakly, with the progression from suicidal ideas to actual attempts (Bruffaerts, Kessler, Demyttenaere, Bonnewyn, & Nock, 2015; Dhingra, Boduszek, & O'Connor, 2015; Glenn & Nock, 2014; Kessler, Borges, & Walters, 1999; Klonsky, May, & Saffer, 2016; Nock et al., 2008; Nock et al., 2013; Nock et al., 2015; Nock, Hwang, Sampson, & Kessler, 2010). CMDs, as keepers, would be expected to activate not respectively in response to suicide attempts – by then it may be too late – but pre-emptively in response to emotional pain as a predictor of suicide risk. The system's goal would be to stop the individual who is in sufficient pain for self-killing to be thinkable from going on to develop or act on those thoughts. The few escapes, incidents in which suicidal thoughts manage to progress to actual suicide attempts, would constitute a filtrate, a residue that is intrinsically (and by definition) beyond the ability of anti-suicide mechanisms to detect or forestall. Any ideation-to-action progressions would therefore be expected to show little, if any, connection with incremental CMD/keeper activity. Suicidogenic forces beyond the reach of CMDs to moderate – undetectable to the organism's systems and/or resistant to its interventions – would expectably characterise these transitions of suicidal thoughts into suicidal deeds. These extraordinary influences may include exceptional feats of high-level cognitive learning – a "practice makes perfect" effect of previous suicide attempts – or other special psychological capability (Joiner, 2005; Klonsky, Qiu, & Saffer, 2017; Van Orden et al., 2010; Weinberg, May, Klonsky, Kotov, & Hajcak, 2017) or a ready physical access to means of suicide (Klonsky & May, 2014, 2015). The requirement for such additional factors over and above the activation of CMDs/keepers may indicate how difficult it normally is to overcome the organism's autonomic anti-suicide defences.

It is not claimed that suicides would occur exclusively among those with CMDs: there may be cases in which suicides arose when (and, arguably because) CMDs/keepers failed to activate. To reprise the physiological analogy of fever as an immune response to pathogen infection, not everyone who dies from infection may be visibly feverish at the time of death: there may be many reasons why fever may not always be observed in these extreme situations, but such cases would not weaken the hypothesis that fever is generally part of the organism's normal armoury of responses to avert death by infection (Cosmides & Tooby, 1999; Symons, 1992).

(q) *Defensive responses would be nearly always recoverable and survivable: they should only rarely cause permanent disability.*

It has been argued already, perhaps counterintuitively, that CMDs as keepers "work" for most people in danger, most of the time. Many people with mental disorders think about suicide, but very few act on their thoughts (Arsenault-Lapierre et al., 2004). The point has also already been made that, while relapses are common, most mental disorders tend to improve, usually over a matter of weeks or months, with or without medical intervention, and are rarely degenerative (Goldberg & Goodyer, 2005; Menninger, 1963). Generally they are associated with only a partial

deterioration in mortality and fertility (Uher, 2009). CMDs would appear on this basis to meet the expectation that, as keepers, they usually leave the individual with at least the potential to survive and reproduce.

(r) *Individuals experiencing active keepers may look and feel as if they are thinking and behaving irrationally.*

CMDs almost by definition entail some degree of irrationality or other impairment to cognitive functioning: the American Psychiatric Association (APA, 2013) defines mental disorders as "a syndrome characterized by clinically significant disturbance in an individual's cognition, emotion regulation, or behaviour that reflects a dysfunction in the psychological, biological, or developmental processes underlying mental functioning." But from the perspective of CMDs as keepers, a measured, sublethal attenuation of cognitive faculties may be understood not so much as irrational but "better than rational" (Cosmides & Tooby, 1994). Suicide may be judged from a subjective viewpoint as a rational response to the experiencing of unbearable suffering (Maris, 1982; Varelius, 2017): natural selection, having other ideas, would be expected to deprive the pained organism of rationality as required to preserve its survival and reproductive prospects. The irrationality of keepers may be understood as a necessary prophylactic, a solution to an adaptive problem that appears to have arisen as an unfortunate concomitant of human rationality.

5.8 Species-Specific and Species-Universal

(s) *Keepers would be species-specific: they would not occur in non-human animals, although homologues of their features may be found in other mammals.*

If CMDs are adaptations that evolved to combat suicide, suicide apparently being a problem that affects only mature humans, then CMDs should expectably not be found in non-human animals – for the same reason that they should not be found in young children: in the absence of a suicide risk, there would be no reason for defences against suicide to evolve. This prediction would appear to be met in CMDs: there is no evidence of non-human animals displaying syndromes that match the diagnostic criteria of CMDs.

This is not to claim that non-human animals are immune from non-human psychopathologies: diverse animal psychopathologies are well documented (Keehn, 1979). And no doubt homologues of CMDs would expectably be found in non-human animals, particularly in those most closely related to humans, because human adaptations would have emerged only through the co-option and genetic modification of pre-existing raw material – ancient features which may have been preserved during the subsequent evolution of related species.

Indeed, many behaviours and emotional states that could constitute evolutionary precedents for some symptoms of CMDs can be observed in other mammals (Panksepp, 2006). Depression, most notably, has been compared with some supposed non-human analogues: in particular the conservation-withdrawal response by

which an animal in a hopeless, trapped situation is believed to minimise further damage to itself, or at least not expend energy on futile struggling (Engel, 1962; Engel & Schmale, 1972; Stengel, 1964), and a learned helplessness that can be induced in laboratory conditions (Overmier & Seligman, 1967). Such non-human responses might point to phenotypic precursors for the evolution of human depression, but human and non-human depressive behaviours may be regarded as only distant cousins: there is no evidence elsewhere in the animal kingdom of a suite of responses as prevalent or as florid as major depressive disorder, triggered not by literal, absolute entrapment but, as in the human case, by the experiencing of merely stressful life situations. Animals under stress in the wild – experiencing severe food shortages, for example – are seen to increase, not decrease their expenditure of energy, and to become more risk-taking in their behaviours rather than withdrawn (Faucher, 2016). Laboratory rodents subjected to chronic stresses early in life tend to show a greater, not lesser, resilience to stress in adulthood (Schmidt, Wang, & Meijer, 2011). The closest that non-human models have got is the artificial inducement of certain depressive-like behaviours – disrupted eating patterns, cognitive deficits, and so on – thought to be comparable to components of human depression, but such atomised phenomena are far removed from the syndromic state by which an animal could validly be labelled "depressive" (Gould et al., 2017). In spite of a concerted research effort over many decades, and despite the considerable resources of the global pharmaceutical industry, no effective animal model of depression *per se*, or of any other psychiatric diagnosis for that matter, has yet been established (Anderzhanova et al., 2017; Gould et al., 2017; Peters, Pothuizen, & Spruijt, 2015; Willner & Belzung, 2015). This limitation has reportedly led, following a series of failed clinical trials, to a curtailment in recent years in the use of animal models for the development of antidepressants and other psychiatric drugs (McGonigle & Ruggeri, 2014; Peters et al., 2015).

Similarly, alcoholism might be traceable to non-human origins, inasmuch as animals have been long been observed to self-medicate using carefully selected, naturally occurring substances (Engel, 2002), and some might be positively drawn to consume alcohol – Dennett (2006) speculates that the natural fermentation of alcohol may have evolved as a three-way symbiotic bargain struck between fruit trees, yeast, and frugivores. And yet, in the laboratory, and again despite a long and costly effort, no non-human animal has yet been shown voluntarily to consume alcohol to the point of dependency (Ramsden, 2015).[8]

[8] The refusal of non-human animals to become addicted to alcohol was known in Darwin's time. Darwin (1871) cites a then famous book by A E Brehm, *Illustriertes Tierleben*:

> Brehm asserts that the natives of north-eastern Africa catch the wild baboons by exposing vessels with strong beer, by which they are made drunk. He has seen some of these animals, which he kept in confinement, in this state; and he gives a laughable account of their behaviour and strange grimaces. On the following morning they were very cross and dismal; they held their aching heads with both hands and wore a most pitiable expression: when beer or wine was offered them, they turned away with disgust, but relished the juice of lemons. (Darwin, 1871, p. 12)

With regard to the delusions characteristic of schizophrenia, neurological bases have been found in other animals to suggest their evolvability. An instinctual filtering appears to be involved in the perceptual processing of information which might have provided scope for autonomic misbelief to emerge – but there is little, if any, evidence that systematic self-deceit is common among non-humans (Erdelyi, 1974; Lockard, 1988; McKay & Dennett, 2009).

(t) *Keepers would be species-universal: the same integrated system of keepers would be found activating among populations of mature humans in all cultures and historical ages.*

Hypothesised here as a universal human response to potentially suicidogenic pain, much the same patterns of symptoms of CMDs would be expected, and are indeed found, to appear across human cultures, although geographic variations exist in CMDs' prevalence and in the proximal psychosocial causes cited for their reported onsets (Khan & Gould, 2011; Mishara, 2006). The correlational pattern linking suicidality with CMDs also prevails around the world (Nock et al., 2008). Depression, most notably, is associated with suicidality worldwide, although culturally nuanced and varying conceptions of mental disorder and mental distress may colour the correlations in different social settings (Milner, Hjelmeland, Arensman, & De Leo, 2013).

5.9 Summary and Conclusions

The sum of the above observations is that diverse symptoms of adult-pattern depressions, alcoholism and other addictions, schizophrenia, and other common mental disorders (CMDs) seem to match the *a priori* specifications of a system of keepers proposed in Chap. 4 – evolved mechanisms designed to attenuate the motivation for suicide and/or the ability to carry out suicide among those at risk. The match appears to hold or at least finds no unaccountable inconsistencies across all 20 points of the specification, including the apparent input role of emotional pain in the patterned provoking of CMD onsets by adverse life events; the mirrored remission of CMDs following the relief of painful life situations (Brown, 2009); the scheduling of the earliest first onsets of CMDs in adolescence and early adulthood, when suicide becomes intellectually practicable (Kessler et al., 2007); CMDs' cognitive and behavioural outputs, which may be understood to make suicide unnecessary and/or difficult to organise (Hendin, 1975; Himmelhoch, 1988); the comorbidity, shared risk factors, and other commonalities that point to a unitary pain-driven aetiology across diagnostic labels (Caspi et al., 2014; Menninger, 1963); the frequent association of CMDs with protracted anxiousness, the prototypical mammalian response to a severe but unlocatable fitness threat (Blanchard, Griebel, & Nutt, 2011; Goldberg & Goodyer, 2005); the presence of CMDs in many or most actual suicides (Cavanagh et al., 2003); the strong association of CMDs with suicidal ideation, but signally not with the transition from idea to action (Klonsky, May, & Saffer, 2016); the absence

of CMDs *per se* among non-human animals (Peters et al., 2015; Ramsden, 2015); the universality of the association between CMDs and suicidality across human cultures (Nock et al., 2008); and other points of alignment.

Abductive reasoning, an argument to the best explanation (Andrews et al., 2002; Harman, 1965), would suggest that the simplest, most plausible way to account for this point-by-point concordance is that some CMD symptoms probably are, in fact, manifestations of keeper mechanisms. The multiple correspondences may be taken as *prima facie* evidence that CMDs show the hallmarks of special design (Tooby & Cosmides, 1992; Williams, 1966): viewed as keepers, some symptoms of CMDs arguably display the complexity, efficiency, reliability, precision, and functionality that Buss, Shackelford, Bleske, and Wakefield (1998) hold to be the *sine qua* non of adaptation.

It is difficult to posit plausible alternatives. The general linkages between CMDs and suicidality noted in this chapter, the tessellation of form and function, point to their shared origins in a much the same way that the matching shapes of the African and South American continental shelves belie an ancient tectonic unity, or interlocking pieces of a jigsaw puzzle evidence common design. It seems unlikely that such mirrored patterning would have come about by chance. There would not appear, either, to be an available alternative evolutionary framework that would otherwise explain the match. Other evolution-informed general theories of psychopathology may help to account, if not for suicide, then for patterns of CMD comorbidity – notably, four theories put forward by Crespi and Badcock (2008), Del Giudice (2016), Keller and Miller (2006), and Uher (2009). These are complex models beyond the scope of this book fully to critique, but some relevant comments may be made. First, it may well be that these other theoretical frameworks can comfortably coexist with the proposals made in this chapter. Crespi and Badcock (2008) and Del Giudice (2016) posit divergent genetic substrates and developmental histories respectively to explain why different clusters of CMDs may be expressed in different individuals. Keller and Miller (2006) point to the role of genetic mutations in influencing individual susceptibilities to psychopathologies, and Uher (2009) posits additional cultural factors which may account for geographic variations. At least some components of all of these models may be consistent with a framework that explains CMDs as species-universal clusters of anti-suicide psychological devices, expressions of which may vary richly from individual to individual and perhaps culture to culture. Second, all four may represent important progressions towards elucidating a shared aetiology that can be presumed to underlie superficially disparate psychopathologies: this general approach may be considered to be a marked step forward from previous ad hoc, disorder-by-disorder evolutionary explanations in psychiatry (e.g., Brüne, 2016; Stevens & Price, 2000), none of which has gained widespread clinical acceptance (Faucher, 2016). Finally, the model proposed here could help to fill some gaps left in other extant evolutionary theories. Among other phenomena, it may account for the patterned course of CMD onsets and remissions, and the strong association of CMDs with suicidality generally, and suicidal ideation in particular, important aspects of psychopathology which call for explanation but which have hitherto been neglected.

It was not the aim of this investigation to arrive at a "grand theory" of psychopathology, but one appears to have taken shape, nonetheless, as an incidental step towards an evolutionary understanding of suicide. Whether the theory is acceptable or not may depend on a judgement as to its parsimony. If the hypothesis of this chapter is rejected – if it is argued that CMDs are not adaptive anti-suicide responses – then it would raise the significant difficulty of having to find alternative real-life phenomena that meet the keeper design specification set out in Chap. 4: in other words, another suite of behavioural and psychological conditions would need to be found that look very much like CMDs, on multiple counts, but which are something else. The call to find a manifestation of keepers would not go away, because the theoretical argument for the existence of some kind of evolved anti-suicide mechanisms would remain. If, as earlier chapters deduced, suicide probably evolved as a by-product of emotional pain, which intrinsically demands escape, combined with the mature human brain that offers oblivion as a means to achieve that escape, and if it follows that virtually all mature humans could use suicide to escape pain, and would do so without some restraint, then those restraints warrant identification. Returning to a point made at the start of this chapter, the action of evolved defences against suicide, responding to the experience of potentially suicidogenic pain, would expectably be commonplace, distressing, and highly visible: if not CMDs, then it is hard to imagine what other phenomena would plausibly fit the *a priori* specification.

A different set of difficulties arise if the hypothesis is accepted. If CMDs do operate as a set of reactive defences against suicide, engaging in response to the experience of emotional pain, then there are empirical and theoretical reasons to believe that they would probably not constitute the organism's entire, or even most active, means of avoiding suicide. First, empirically, common experience is that most people, most of the time, appear to be able to deal with emotional pain without being overtaken by clinical depressions, addictions, or any of the other drastic measures described in this chapter. It seems that most people will at some stage experience one or more potentially traumatic life event distressing enough to warrant a diagnosis of PTSD (post-traumatic stress disorder) (Norris, 1992), and yet few people do go on to suffer from PTSD as a result or any other serious mental disorder for that matter (Boden, Kulkarni, Shurick, Bonn-Miller, & Gross, 2014; Bonanno, 2004; Breslau et al., 1998; Kessler et al., 2005; Ozer, Best, Lipsey, & Weiss, 2003). Second, theoretically, it would be illogical to expect the organism to resort to crisis-type interventions, which clearly impair the organism's survival and fertility prospects, without there also being pre-emptive systems in place designed to avert the need for such costly emergency measures. A reliance on psychological firefighting without fire prevention would be as implausible as a body relying on the immune system to fight infections without also having skin and mucus membranes to stop the bulk of pathogens invading, or without disease-avoidance behaviours to keep the organism away from pathogens in the first place (Schaller, 2011). Keepers are hypothesised to be an adaptive solution to an adaptive problem, but they in turn present a recurring, predictable fitness threat of their own, which is unlikely to have

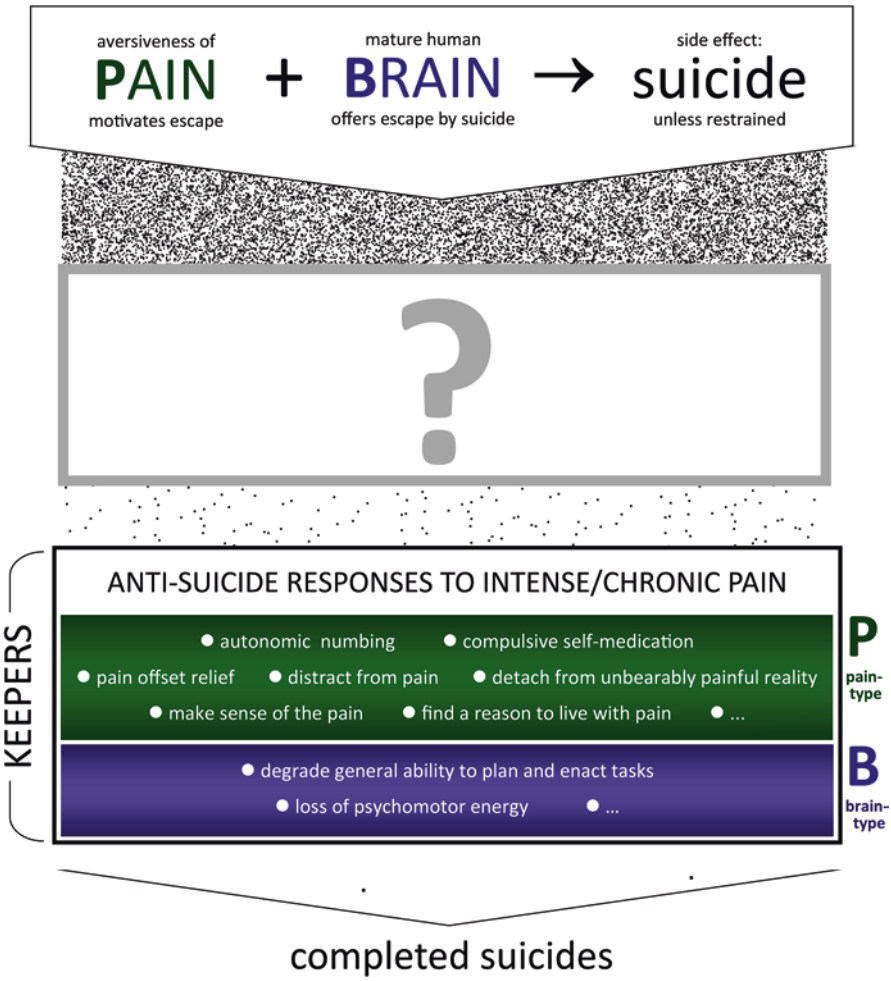

Fig. 5.2 A predicted front line of defence. (The posited existence of keeper anti-suicide systems, these being expensive to mobilise, points to an as yet unidentified forward line of defences, designed to avoid keepers having to activate except as emergency responses)

been left unaddressed by natural selection. In other words, the very existence of a reactive, last line of defence implies the presence of an active, frontline defence.

Put graphically, the evolutionary paradox of suicide, as it stands at the close of this chapter, might be summed by Fig. 5.2: a coherent evolutionary theory of suicide would seem to remain incomplete without an account of the systems that expectably ought to have evolved to allow keepers to remain in a dormant, potential, latent state for most people most of the time. The next chapter investigates some possible characteristics of these predictably existent, but unexplored, frontline prophylactics.

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Chapter 6
"Pain-Type Fenders": Frontline Anti-suicide Mechanisms

Yes, a man can get used to anything, but do not ask us how. –
Victor Frankl (1946/2011, p. 30)

To make a brief review, Chap. 2 argued that suicide probably arose deep in human prehistory as a noxious evolutionary by-product – one that, according to Chap. 3, would have presented a grave and recurring fitness threat. At the point at which human cephalisation passed the cognitive floor for suicide (Perry, 2014), a threshold of consciousness and logical thinking at which self-killing became available as a means to obey the biological demand to escape pain, suicide can be presumed to have constituted a recurring and lethally dangerous feature of the human evolutionary environment. Specific adaptations would expectably have evolved by natural selection to counter the threat. In search of these, Chap. 4 explored the expectable design features of a suite of last-line, anti-suicide, evolved psychological mechanisms – keepers – designed to prevent intentional self-killing among those at heightened risk. Keepers, it was argued, would have emerged to moderate the likely "pain and brain" originators of suicide: the aversiveness of pain, which motivates suicidal escape, and the mature human brain that offers the means. It was reasoned that keepers would activate in adolescent and adult humans in response to suicidogenic pain, either to make suicide unnecessary, by numbing or otherwise neutralising the painful motivation, or to make suicide difficult to organise, by degrading the capacity to plan and enact an effective suicide endeavour, or by a combination of both strategies. The symptoms of depression, addiction, and other common mental disorders (CMDs), observed in Chap. 5, appear to match the expected design features of keepers on multiple counts: indeed, it is difficult to think of phenomena other than CMDs that would correspond to the specified *a priori* design.

The problem now arising is that, if this account is broadly correct, an exploration of the evolutionary origins of suicide cannot end there, as Chap. 5 concluded. A further line of anti-suicide defences can be presumed to exist, based on at least two lines of evidence. First, common experience is most humans most of the time can and do experience varying degrees of pain and distress without obvious CMD symptoms as activated keepers, let alone suicide: one in three Americans report

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having had psychiatric problems in a past year (Kessler et al., 1994), but it remains unexplained how the other two in three apparently remain in good mental health. CMDs are anyway usually not permanent states (Goldberg & Goodyer, 2005), so the anti-suicide protection they may provide can only be temporary.

The second reason why a line of defences ahead of keepers would be expected is theoretical. That mankind's fully functioning "pain and brain" adaptations confer, on average, a reproductive fitness advantage follows by definition from the identification of suicidality as one of their noxious by-products (Chap. 3): to posit a by-product presumes the existence of an overridingly more valuable primary product. To lose part of the normal functioning of "pain and brain," as primary adaptions, is therefore to forfeit part of the fitness gain they would otherwise provide. It follows that an activated keeper, in attacking the pain/brain co-authors of suicide, necessarily levies a fitness cost. The activation of an anti-suicide response would expectably be categorically less costly than the alternative (i.e., death by suicide), but, as a compromise solution, it would not be cost-free. The fitness downside of CMDs/keepers is visible in the marked impact CMDs have on fertility rates: people with mental illnesses tend to have fewer children than do "normals," probably because the mentally ill find it harder to compete for mates (Keller & Miller, 2006). In view of the social deviance and practical adversities intrinsic to CMDs' symptoms, CMDs can be presumed to have impaired fitness and gravely so, throughout human history (Keller & Miller, 2006). It follows that CMDs, as activated keepers, would themselves have presented a severe and recurring fitness threat in the human evolutionary environment, a pressing adaptive problem that natural selection would not plausibly have left unaddressed. Over the course of human evolution, natural selection would expectably have strongly favoured adaptations designed to avert the necessity for keepers to activate. It is predicted that such adaptations exist in theory and that they ought to be found in practice.

This prediction, that a line of anti-suicide defences ahead of keepers ought to be in place, may be supported by expanding on the analogy with the physiological immune system drawn in the previous chapter. Immune responses are costly to mobilise in terms of both the metabolic drain on resources and the debilitation caused to the organism while it is combatting an infection, and sometimes, anyway, the system fails. Hence the organism retains a battery of front-line defences against pathogens, such as skin and other membranes, and infection-avoidance behaviours, designed to avoid reliance on the immune system – to allow the immune system to be deployed only in emergencies. By the same principle, it would be expected that humans are characterised by extensive, pre-emptive protections against suicide: rather than leave the organism to reach a point at which drastic, reactive, last-ditch defences are all that stand in the way of an actual suicide attempt, less costly defences would be expected to operate actively to keep the individual at a safe distance from such a crisis. As Zoonen (2015) points out, in mental health as elsewhere, an ounce of prevention is worth a pound of cure.

This chapter attempts to infer the likely features of these hypothesised front- or first-line, anti-suicide, evolved psychological mechanisms – henceforth, *fenders*. Keeping a team sports metaphor in mind, the label is to suggest the role and style of play of a centre back or sweeper in soccer — a defensive player whose primary job

is to keep the ball away from the team's goal, and to avoid a crisis situation in which the goalkeeper, the team's last line of defence, must mobilise to intercept an attacking shot. Like keepers, fenders will be referenced in the plural, partly not to blinker the inquiry to the possibility that there may be more than one and partly on the expectation that, in view of the twin pain/brain nature of suicide's causation, there probably will be more than one. To make a cautionary point, while a dichotomy between frontline and last-line defences may be helpful as a conceptual framework, the reality would probably be more complex and nuanced. There may be much overlap, and indeed the psyche may operate so seamlessly that to try to draw boundaries may be to risk reifying of what really are the perspectives of a single indivisible system.[1]

Following the framework established in earlier chapters, the "pain and brain" model of suicide's evolutionary origins offers two conceptually distinct dimensions in which fenders would be expected to operate, which will be explored in turn. It will be first considered how pain-type fenders might work, presumably regulating the experiencing of emotional pain sufficiently to avoid the costly ignition of keepers. Then, in the subsequent chapter, the possibility of brain-type fenders will be explored – frontline mechanisms designed to keep the cognitive option of suicide closed off to everyone, pained or not, but most saliently to those whose pain would give them motivation to seek a suicidal escape.

The system objective of pain-type fenders, it is proposed, is to avoid, as far as is possible within the constraints of a trade-off of fitness costs, the triggering of expensive, emergency, last-ditch defences against an imminent suicide threat – that is, the activation of keeper mechanisms that Chap. 5 posited to manifest in symptoms of depression, addiction, and other CMDs.

Some particular varieties of pain-type fenders might reasonably be hypothesised, to be discussed later in this chapter but some anticipated general design features of pain-type fenders will first be reviewed.

6.1 General Anticipated Features of Pain-Type Fenders

6.1.1 System Inputs and Developmental Onsets

Because keepers, as the fitness threat that pain-type fenders would have evolved to counter, are posited to be activated by the emotional experience of pain (4.3.1), it follows that much of the same pain cue would be expected to operate as the main informational input for systems designed to pre-empt that activation. As is the case with keepers, it can be presumed that the salient independent variable is the

[1] First- and last-line anti-suicide systems might be better understood as regions on a continuum: some fenders might simply be keepers operating at a basic level of activity, like the idling of an engine; conversely, some keepers may simply be extreme instantiations of fenders. Or they might operate like a sports team mounting a defence, forward and back team members sometimes playing out of position as the situation requires.

unidimensional aversiveness of emotional pain, largely or wholly regardless of the type or origin of the pain, and calibrated so that, *ceteris paribus*, the more intense the pain input, the more intense the mechanism's output. Other secondary inputs might apply as moderators to the primary cue of pain – there might be individual differences in the expression and intensity of fender responses to reflect, for example, gender, personality variables, cultural contexts, differences in individuals' sensitivities to emotional pain, and other factors – in particular, age.

Age, or rather an organismic cue that probably correlates with age, might be expected to moderate the developmental pattern of fenders, on the grounds that keepers – and the suicide risk that keepers would address – are not a significant danger until the brain has matured to the stage of being able to conceive and organise suicide, at around puberty or early adolescence (4.3.2). However, as a point of possible difference compared to keepers, fenders may be expected to act pre-emptively: it may serve for fenders to operate throughout childhood to some extent, with the aim of preventing the organism from reaching puberty with an already intolerable burden of pain. For this reason, the timing of fenders' first onsets may not be as clearly defined as the earliest onsets of keepers.

6.1.2 Obligate, Instinctual Responses

Like keepers, fenders would operate largely as obligate, involuntary behavioural and cognitive mechanisms, on the grounds that there would be little to be gained and much potentially to lose, from leaving the organism to acquire defences against a rare but potentially severe threat by trial-and-error learning (Fessler & Machery, 2012; Rachman, 1977; Williams, 1996). The primary input cue of pain, autonomically generated, would not anyway in itself require a process of conditioning to learn, and the grave fitness threat associated with of activated keepers – a marked loss of fertility – would point to there being safety in instinctual responses that resist volitional, conscious moderation. The gravity of the threat would also imply that an individual would be largely blind to the instinctual operation of fender defences (Cosmides & Tooby, 1994b).

6.1.3 Deactivation

Unlike keepers, which, as emergency interventions, would demobilise in time following relief of the provoking pain input, fenders would not be expected to display a patterned standing down. Rather, fenders would be expected to remain fully active throughout adulthood, operating to keep the aversive experience of pain below the suicidogenic level that would trigger keepers.

6.2 Regulating the Experiencing of Painful Events by Self-Serving Self-Deception (SSSD)

The goal of pain-type fenders, it is argued, would be pre-emptively to contain the experiencing of emotional pain below a level that would otherwise incur, not the catastrophic fitness cost of suicide itself but the lesser but still severe fitness cost of keeper reactive defences against suicide – the symptoms, it is posited, of CMDs. Pain-type fenders, in other words, would function to forestall the damage to inclusive fitness caused by psychopathology.

6.2.1 The Previewing and Editing of Bad News

The flow of emotionally adverse information from the environment cannot entirely be avoided: losses, deprivations, and encounters with other distressing events and conditions would appear to be an unavoidable part of being human, or being a mammal for that matter (3.3.1). Given this fact of life, the focus of a fender design specification would presumably be directed at ameliorating the subjective experiencing of those painful events. A fender mechanism would expectably be favoured by natural selection if it modified incoming painful information in such a way that a suicidogenic threshold of pain tolerance was not exceeded. The system would ideally be designed selectively to target emotionally aversive information, partly because (a) it is only information with negative emotional content that would trigger a keeper, so there would be no recurring association between pain-free events on the one hand and keepers on the other for natural selection to respond to, and partly because (b) the organism would be expected to benefit from maintaining the most accurate appraisal of relevant environmental information as possible – in a trading off of fitness costs, the less interference to its general sensory/perception faculties, the better.

This need to modify painful information, and only painful information, implies a significant cognitive challenge – one that would arise ultimately from the adaptive problem of suicidality and one that, if humans are nature's first suicidal species, would be evolutionarily novel for life on earth. The challenge implies a requirement for the organism to prescreen incoming information – to preview the emotional content of life events and conditions – before it is processed further or admitted to conscious awareness. Having identified which items of information may potentially cause pain, the ideal system would filter the adverse information and, perhaps to a level that depends on the organism's prior emotional state, selectively moderate or suppress the information before the concomitant pain can be fully sensed. In relation to the normal needs of animal cognition, this hypothesised pre-emptive editing of bad news would seem to be a radical procedure and perhaps unique: the human organism alone would expect to gain from a capacity to receive true information from the environment – information that, while distressing, might have important

fitness value in other circumstances – and then, within a trade-off of fitness costs, ignore it or quarantine it or distort it, in the interests of maintaining mental health. For the system to meet its fitness goal, little or none of this editing could be available to conscious awareness or intervention: from the individual's internal subjective experience, there would be little or no reason to suspect delusional or irrational thinking – although delusion and irrationality may be, it can be imagined, signal to outside observers.

Such a system would appear to be biologically unusual but at least in principle evolvable. The capacities to make affective and cognitive assessments appear to arise from separate and partially independent domains of mental functioning, the emotional content of new information registered ahead of cognitive judgements (Zajonc, 1980). Neurological evidence suggests, in addition, that the human brain can and does modulate the experiencing of pain, sending modifying signals outward towards pain receptors, variously muting, amplifying, delaying, and otherwise adjusting the felt experience as appropriate to the needs of the situation (Melzack & Wall, 1967; Wall, 1999). Psychological pain appears to use much of the same neural circuitry as physical pain (Eisenberger & Lieberman, 2004), on which basis the experiencing of emotional pain may similarly be under the brain's regulation. It will be recalled that, in the light of some common ways in which the organism manages physiological pain, some autonomic methods of emotional pain relief were proposed in Chap. 4 (4.5.1) – then in the context of possible types of keeper response. These suggestions included the use of distraction, the selection of beliefs that may provide a rationale for the existence of pain, and the selection of reasons for soldiering on in spite of it.

Conceptually similar responses to keepers might equally appear in a hypothesised suite of possible fenders but expressed on perhaps a less florid, less costly level. If so, as was posited to be the case with keepers, diverse fenders might be regarded as alternative means to the same end – driven by the same primary inputs (the pain content of incoming information) and with a common objective (in the case of pain-type fenders, to avoid activating keepers). Multiple pain-type fenders might therefore be viewed as functionally equivalent, and to some degree operationally interchangeable, defending conscious awareness in varied ways from an overload of painful reality. They might express themselves in diverse combinations and sequences in different individuals and at different times, all in the interests of maintaining a broadly serviceable state of mental health.

6.2.2 Psychodynamic Defences and Self-Serving Self-Deception (SSSD)

Apart from the posited evolutionary logic – meeting the human organism's need to avoid having to trigger psychopathological anti-suicide defences – the idea of protective, systematic self-deception is not new. Clinicians at least since the time of Freud (1901/1976, 1917/1964) have observed the human mind's readiness to distort

the conscious experiencing of an unwanted reality. Darwin himself was well aware of his own mind's tendency to filter bad news, as he writes in his autobiography:

> I had, also, during many years, followed a golden rule, namely, that whenever a published fact, a new observation or thought came across me, which was opposed to my general results, to make a memorandum of it without fail and at once; for I had found by experience that such facts and thoughts were far more apt to escape from the memory than favourable ones. (Darwin, 1958, p. 123)

What might loosely be classed as psychodynamic defences, "largely unconscious or automatic efforts to maintain psychological stability in the face of internal or external stressors though the modification of how reality is perceived" (Malone, Cohen, Liu, Vaillant, & Waldinger, 2013),[2] have been identified, renamed, and reclassified over much of a century (Cramer, 2000). Anna Freud (1936/1993) records ten types that appear in her father's works: repression, regression, reaction formation, etc. A rival, four-tiered, nosology put forward by Vaillant (1993, p. 36) illustrates their variety[3]:

I *Psychotic (delusional projection, denial, distortion)*
II *Immature (projection, fantasy, hypochondriasis, passive aggression, acting out, dissociation)*
III *Neurotic/intermediate (displacement, isolation/intellectualization, repression, reaction formation)*
IV *Mature (altruism, sublimation, suppression, anticipation, humor)*

Alternative models and schemes have been proposed by Festinger (1957), Greenwald (1980, 1988), Gyurak, Gross, and Etkin (2011), Taylor and Brown (1988), Westen and Blagov (2007), Weinberger (1990), Kuhl (2000), Mauss, Bunge, and Gross (2007), and other workers, cumulatively exemplifying the diverse means by which the human mind seeks automatically to buffer itself from unpleasant information (Bonanno, 2009; Gilbert, 1989; Gilbert, Pinel, Wilson, Blumberg, & Wheatley, 1998; Gross, 2014; Koole, 2009; Koole & Rothermund, 2011; Kuhl, Quirin, & Koole, 2015; Lockard & Paulhus, 1988; Steele, 1988).

A thread that connects the many, overlapping, and multiplying concepts in this domain is the idea of self-serving self-deception (SSSD) – that human beings can and do self-servingly deceive themselves (Paulhus & Buckels, 2012; Sackeim, 1988; Shepperd, Klein, Waters, & Weinstein, 2013; Von Hippel & Trivers, 2011). Taylor and Brown (1988) note three closely interrelated aspects of this phenomenon: the maintenance of an unrealistically positive view of "me and mine" – the self and its associates; an unrealistically favourable assessment of the self's personal control over the world; and an unrealistic optimism for the future. The existence of SSSD has solid empirical support, seminally from the experimental finding by Gur and Sackeim (1979) that people are apparently able to hold two contradictory beliefs at

[2] The definition by Malone et al. (2013) refers to psychological defences – renamed psychodynamic defences in this book to avoid confusion with other uses of the term.

[3] There may be more – Vaillant (1977, p. 79) suspects there may be "as many defenses as the cataloguer has the temerity to imagine."

the same time, one favourable, one unfavourable, and be aware of the one while unaware of the other. Crucially, and as anticipated by the hypothetical fender system outlined above, the readiness of the mind to bring information into awareness depends on its emotional valence: people are generally better able to take on board good news – positive, self-affirming data – than bad (Sharot & Garrett, 2016; Sharot, Korn, & Dolan, 2011). The mind, it seems, does indeed scan incoming information for its emotional potential before encoding it into memory or releasing it into consciousness, and it can withhold adverse information that is in fact true (Erdelyi, 1974; Greenwald, 1988; Schwartz & Wiggins, 1992). Objectionable memories can apparently be put beyond recall (Bonanno, 2009; Brezo et al., 2007). The conscious mind meanwhile remains blind to the process, with the outcome that we believe we are thinking and acting rationally (Stevens, Guise, Christiana, Kumar, & Keenan, 2007). While individuals differ in how and to what degree they self-enhance (Schriber & Robins, 2012), and while societies differ in the desired traits around which to self-enhance (Heine, 2005), moderate self-enhancement appears to recur as a cross-cultural, normal, feature of human psychology (Sedikides, Gaertner, & Toguchi, 2003; Sedikides, Gaertner, & Vevea, 2005). This apparent universality of SSSD may point to ancient origins in mankind's evolved psychology (Haselton, Nettle, & Andrews, 2005; Haselton, Nettle, & Murray, 2016; Sharot, 2011b). It may also be unique to our species: optimism may be a strategically useful stance in low stress environments (Sharot & Garrett, 2016), and there may be rudimentary phylogenetic precursors of aspects of SSSD in other animals (Lockard, 1988), but evidence is signally lacking that any non-human animal systematically overrates its own capabilities or the benignity of its environment.[4]

6.2.3 The Evolution of SSSD

The evolutionary origin of psychodynamic defences, and the SSSD that characterises them, has yet to be convincingly explicated. There is some unanimity at least concerning the state the human mind seeks to avoid – emotional pain – although, as noted earlier in Chap. 3, pain registers in the literature confusingly "as one malady with many names" (Biro, 2010). The feeling is variously described as unpleasure and anxiety (Freud, 1936/1993), uncertainty (Van den Bos, 2001), hurt (Baumeister, 1989), disequilibrium (Piaget, 1961), lowered self-esteem (Taylor & Rachman, 1992), misery (Hoerger, Quirk, Lucas, & Carr, 2009), a loss of a sense of adequacy (Sherman, 2013), dissonance (Festinger, 1957), terror (Pyszczynski, Greenberg, & Solomon, 1997), an overdose of gloom (Gilbert et al., 1998), and so on. Proulx (2013) offers, only half-jokingly, an ecumenical "disanxiousuncertlibrium."

[4] Most rats in one sample were found, rather, to be pessimists (Rygula, Golebiowska, Kregiel, Kubik, & Popik, 2015).

6.2.3.1 A Missing Variable: The Fitness Costs of Negative Effect

The desire to avoid feeling bad, by whatever name, offers only a partial, proximal explanation for psychodynamic defences. The problem from an evolutionary perspective is to explain why in ultimate, biological terms such feelings should need defending against: why, over the course of human evolutionary history, negative affect should have been so disadvantageous to the organism's reproductive fitness that it drove the selection of a baroque complexity of psychodynamic defences to avoid it.

One particular adverse emotional state posited to be averted by psychodynamic defences, a terror of death, is in practice hard to find (DeWall & Baumeister, 2007; Muraven & Baumeister, 1997). As for other putatively avoided threats, it may feel intuitively true (and at a proximal level of causation be true) that, as Vaillant (1977) asserts, ego defence mechanisms are usually employed for psychological objectives:

1. *To keep affects within bearable limits during sudden life crises (*e.g.*, following a death)*
2. *To restore emotional balance by postponing or channeling sudden increases in biological drives (*e.g.*, at puberty)*
3. *To obtain a time-out to master changes in self-image (*e.g.*, following major surgery or unexpected promotion)*
4. *To handle unresolvable conflicts with people, living or dead, whom one cannot bear to leave*
5. *To survive major conflicts with conscience (*e.g.*, killing in wartime, putting a parent in a nursing home)* (Vaillant, 1977, p. 10)

But it is nowhere spelled out what fitness penalty would expectably follow from *not* meeting such psychological needs – what one would do, to make explicit the obverse of Vaillant's (1977) objectives, if affect becomes unbearable, if emotional balance were not restored, if time-out could not be obtained, if unresolvable social conflicts could not be handled, and if one could not survive conflicts with one's conscience. What is it about such unbearable, unresolvable, nonsurvivable outcomes that would provide a biological impetus for the evolution of complex, autonomic defences against them?

The question calls for an answer because, importantly, psychodynamic defences would not appear to come cost-free. SSSD can be presumed to be expensive in fitness terms, because the loss of truthful information about the self and the world would expectably undermine the organism's ability to forecast accurately and to make good decisions (Gilbert & Ebert, 2002; Sharot, 2011b; Taylor & Brown, 1988; Weinstein, 1980). Among non-humans, rational Skinnerian conditioning seems to prevail so that past outcomes are taken into account when forecasting the future: if a rat fails in a certain task a few times, then it learns not to expect to succeed the next time (Skinner, 1938). Humans, by contrast, are not objective predictors (Sharot & Garrett, 2016). There is, for example, the "planning fallacy": projects usually take longer than expected, but because our expectations resist being updated, in spite of a lifetime's experience of overruns, projects continue to take longer than we expect

(Koole & van't Spijker, 2000; Sharot, 2011a).[5] Overoptimistic decision-making lies behind recurring errors small and large, from personal gambling mistakes and business failures (Carver & Scheier, 2014) to economic booms and busts (Bracha & Brown, 2012) and to disastrous wars waged by overconfident leaders (Pinker, 2011). The misallocation of time and other resources arising from even mild forms of self-delusion would expectably have had costly consequences in humans' ancestral struggle for survival (Baumeister, 1989; Gilbert & Ebert, 2002). Presumably, then, a powerful counterbalancing variable exists – a fitness advantage from SSSD that would have caused the trait to be maintained in the human species in spite of the expense.

A coherent explanation of the evolutionary value of SSSD as yet seems to elude science (Johnson, Blumstein, Fowler, & Haselton, 2013; Krebs & Denton, 1997; Krebs, Denton, & Higgins, 1988; Marshall, Trimmer, Houston, & McNamara, 2013). The answers are unlikely to lie in SSSD's direct behavioural effects: if a fitness payoff lay purely in an improved behavioural performance, then natural selection could presumably have favoured optimistic-like behaviours, without going to the lengths of distorting perception, memory, and other aspects of cognition as well (McKay & Dennett, 2009; McKay & Efferson, 2010). The evidence, rather, points to SSSD as a doxastic and affective phenomenon, not just behavioural – the individual's beliefs and emotional states, not just actions, appear to matter (Galperin & Haselton, 2012).[6] The main evolutionary explanations for SSSD to date focus not so much on this mood-managing effect of SSSD but on social dynamics: Trivers (1976, 1985, 2010) suggest we deceive ourselves in the interests of more convincingly deceiving others, that the fitness cost avoided by SSSD may lie in the incremental risk of our deceptions being detected were we not self-deceived. Johnson and Fowler meanwhile argue that an aggrandised self-image may help to intimidate others in fights for resources (Johnson et al., 2013; Johnson & Fowler, 2011). Others argue there may be social advantages in being resiliently positive (Pinker, 2011) or by impressing others through display (Sedikides et al., 2003) – SSSD may indeed make for good first impressions (Paulhus, 1998). There may be some truth in all these social effects, but none would constitute a sustainable strategy on an evolutionary time scale because audiences that became attuned to ignoring dishonest signals and calling a self-deceiver's bluff would be selectively favoured (Gangestad, 2011). Once first impressions have worn off, overconfidence seems rather to be socially counterproductive (Paulhus, 1998). A consensus seems to have settled on the primary drivers of self-enhancement being intrapsychic rather than interpsychic – psychological rather than interpersonal (Chance & Norton, 2015;

[5] Ironically, and perhaps by the same dynamic of SSSD, mental health professionals persistently overestimate their ability to predict suicide risk (Gale, Hawley, Butler, Morton, & Singhal, 2016), despite consistent evidence, from decades of research, of the futility of suicide risk assessment (Mulder, Newton-Howes, & Coid, 2016).

[6] It may be true, incidentally, that stress can exacerbate some general health problems (Sapolsky, 2007), but these effects would seem an unlikely evolutionary driver for such elaborate psychological machinery as SSSD, and some forms of SSSD may anyway bring long-term health costs of their own (Weinberger, 1990).

Schriber & Robins, 2012). SSSD seems aimed primarily at keeping ourselves feeling positive, happy, and hopeful, largely regardless of whether others are fooled or not (Weinberger, 1990).

6.2.3.2 Cognitive Bias, SSSD, and Suicide

Pointing the way to a possible solution to the evolutionary puzzle of SSSD is the wider phenomenon of cognitive bias, this being the business of making optimum choices between opposing but unequal errors. The evolutionary value of cognitive bias is well understood: where to err on one side is cheap but on the other side expensive, then it may be adaptive to make many of the cheap errors to avoid the expensive one (Green & Swets, 1966; Haselton et al., 2016; Haselton & Nettle, 2006). As Funder (1987) points out, an error is not the same thing as a mistake: the evolved brain, built to execute adaptive programmes rather than to avoid errors *per se*, may tolerate many self-protective misbeliefs accurately to deal with cost asymmetries (Boyer & Barrett, 2005; Haselton et al., 2009; Tooby & Cosmides, 1990). For example, the illusion that the same verticle distance appears longer if viewed from above than from below probably helps us to stand clear from dangerously sheer drops (Haselton & Buss, 2000, 2009). If the adaptive logic of SSSD is to be understood, then there needs to be some such account of the asymmetry of fitness costs involved – what cost of low mood is so grave that it is worth systematically erring for the sake of preserving good mood?

A potential evolutionary logic for a cognitive bias underlying SSSD could rest in the anti-suicide specification of a pain-type fender: the fitness catastrophe of suicide ultimately, and the lesser but still major cost of activated keeper anti-suicide defences proximally, may be expected to drive the natural selection of systems designed to shield the organism from Proulx's (2013) "disanxiousuncertlibrium" – or to recall Shneidman's (1993) label for what may be a similar catch-all notion, psychache, emotional pain, the common author of suicide. The biological penalty of experiencing too much painful reality could be severe indeed if it triggers either keeper anti-suicide defences – depression, addictions, psychoses, and other drastic responses to potentially suicidogenic levels of distress – or, if keepers fail, suicide itself (Hundert, 1992).

6.2.3.3 The Optimum Margin of Illusion and Depressive Realism

This cost of erring too far on the side of emotional pain might be grave enough to tolerate a certain level of forecasting error and other downsides of SSSD, a compromise position of a kind that Baumeister dubs the optimal margin of illusion (Baumeister, 1989; Gana, Alaphilippe, & Bailly, 2004). Measuredly bounded by practical fitness-preserving constraints, well-adjusted SSSD usually avoids becoming too attached to beliefs that may be easily disconfirmed, and it keeps the individual in close enough contact with reality to avoid major failures (Armor & Taylor, 1998; Aspinwall, Richter, & Hoffman, 2001; Taylor & Brown, 1988).

The phenomenon of depressive realism – "sadder but wiser" – hypothesised by Alloy and Abramson (1979) might be understood in this light as an evolutionary compromise: dispositional realism may enable more accurate forecasting, but it apparently comes at the price of a greater vulnerability to depression (Kim & Chiu, 2011).[7] Meanwhile, as intuition might expect, dispositional optimism and self-enhancement, presumably at the expense of poorer forecasting, usually associate with better mental health outcomes (Gupta & Bonanno, 2010; McAllister, Baker, Mannes, Stewart, & Sutherland, 2002; Rasmussen & Wingate, 2011; Sharot & Garrett, 2016; Taylor & Armor, 1996; Tucker et al., 2013; Wingate et al., 2006).[8] This implied trade-off between realism and psychopathology may point to optimism and depression, or more generally fenders and keepers, as being partially interchangeable means to the same anti-suicide end: suicidogenically painful information can either be blocked at source by SSSD or given entry and managed closer to the point of suicidality by a depressive keeper, but both types of responses may be similarly protective against a suicide outcome. To use a physiological metaphor, it may be that the thinner an animal's skin, the busier its immune system: conversely, and by a sporting analogy, the stronger a soccer team's defenders (fenders), the less the pressure on its goalkeeper (keepers).

6.2.3.4 Development of SSSD

If self-serving self-deception (SSSD) can be understood as a form of fender, then its developmental emergence might be expected only shortly to pre-empt that of suicide risk in childhood, but the evidence suggests otherwise: pre-pubescent children are apparently more, not less, susceptible to self-aggrandising illusions than are adolescents (Moutsiana et al., 2013; Schriber & Robins, 2012; Sharot & Garrett, 2016; Thomaes, Reijntjes, de Castro, & Bushman, 2009). Why this pattern occurs is unclear. It might perhaps be understandable in the light of the disproportionate and lasting effects childhood adversity may have on mental health and suicidality in adulthood (Bruffaerts et al., 2012; Green, McLaughlin, Berglund, et al., 2010; Kessler et al., 2010; Rutter, 2000), a possible kindling effect that might make the down-regulation of emotional pain in childhood even more important as an anti-suicide strategy than it is in later years, even though children may not yet be at imminent danger of actual suicide.

It may, however, be that children's and adults' unrealistic optimism are discrete phenomena. Harter (2012) suggests that young children may not be capable of, and have no need for, SSSD. A prerequisite of the selective filtering of emotionally adverse updates, characteristic of SSSD, is a conceptual framework by which to assess the updates' emotional content, a framework which young children may not yet possess. Rather, children appear to start life from a point of inflated self-esteem

[7] Although not all studies concur, a meta-analysis of 75 empirical studies points to there being slight depressive realism effect (Moore & Fresco, 2012).

[8] But see Davidson and Wingate (2013), a study that does not replicate this association.

through a simple inability to distinguish the desired from the actual: there is, in other words, no necessity for self-deceiving self-enhancement because their self-views are already enhanced. That under-5's tend to overestimate their skills may reflect the fitness value of a predominant motivation to experiment (Bjorklund & Blasi, 2005), while the acquisition of SSSD develops alongside increasing cognitive sophistication (Cramer, 1983; Cramer & Brilliant, 2001).

For normal, healthy adults, the fender model suggests that SSSD may be part of our regular species-typical psychological functioning. Delusions, some researchers argue, may not be an exclusive feature of the mentally ill but operate rather at some level on a continuum across the human population (Peters, 2010; Van Os, Hanssen, Bijl, & Ravelli, 2000). SSSD may perhaps be understood as a subclinical form of the pain-type keeper delusions described in Chap. 5 (5.4.2). Some level of self-serving delusion appears indeed to be part and parcel of good mental health, providing a bulwark against random adversities (Hansen & Pronin, 2012) and intensifying in response to painful life circumstances – or "coping ugly," in Bonanno's (2009) phrase. Towards old age, as the emotional strain arising from declines and losses intensifies, SSSD appears to become more pronounced (Schwager & Rothermund, 2014), a pattern consistent with the idea that SSSD, as a fender defence, may become a more salient buffer as one's vulnerability to potentially suicidogenic pain increases.

6.3 The Delusional Basis of Subjective Well-Being (SWB)

This section will argue that SSSD is unlikely to be the only first-line defence (fender) that evolved to keep humans safe from psychopathology (keepers) most of the time, because of a limitation inherent in its design. It is argued above that, while effective as a defence against potentially suicidogenic psychache, SSSD can operate only within a compromise of balanced fitness costs. There is a limit to how self-deceived a person can be before the penalties of social failures and poor decisions make deeper self-deception counterproductive (Baumeister, 1989).

Before exploring the implications of this point, it is worth reprising what would seem to be an essential distinction between the management of human and non-human pain. Any animal must retain some grasp of the reality of its environment in order to steer itself away from danger. As was discussed in Chap. 3 (3.1.2), pain as a signalling system serves an adaptive purpose: it protects the animal from fitness threats. It does so apparently by combining two elements, one informational, the other motivational (Brand & Yancey, 1993; Klein, 2015; Wall, 1999). The informational component imparts an intentional message that points to a detected fitness hazard – in the case of emotional pain, probably a threat to vital social relations (Baumeister & Leary, 1995; Bowlby, 1969/1997; MacDonald & Leary, 2005; Papini, Fuchs, & Torres, 2015; Thornhill & Thornhill, 1990; Williams, Forgas, & Von Hippel, 2005) and/or meaning systems (Hicks & Routledge, 2013).

The motivational component, intrinsically aversive, demands action to remove or escape the threat, and it enables the animal to learn to avoid the danger in the future (Auvray, Myin, & Spence, 2010; Martínez, 2011). It follows, from the existence of the motivational strand, that pain is already biologically designed to be minimised: if a system were conceived simply to avoid or minimise the experiencing of pain, then the entirety of any healthy animal could already be viewed as such.

The distinction for the human animal is that, operating via SSSD, a fender defence would aim to suppress specifically the motivational component of psychological pain – its informational content ideally being left intact. The limitation of this strategy, by itself at least, is that, without some motivational impetus, the information would be otiose: *some* painfulness would need to be retained to induce the organism to address the fitness threat that pain evolved to draw its attention to. Annulling the painfulness of pain completely may be an adaptive emergency measure – as in the stress-induced analgesia experienced in trauma (Butler & Finn, 2009) or, as Chaps. 4 and 5 argued, an extreme keeper anti-suicide response – but it would not be a sustainable state. As the leprosy surgeon Paul Brand observes, pain is a precious gift, albeit a gift nobody wants (Brand & Yancey, 1993).

So, the outright elimination of pain would not be a workable strategy. But at the same time, any pain, for a suicidal animal, could be too much. Shneidman (1998, p. 248), it may be recalled (3.1.3), postulates the existence of a pain threshold of suicidality – "a critical line somewhere in the mind," at which the quantitative intensity of pain becomes qualitatively intolerable. To posit such a threshold, below which pain is acceptable, may feel intuitively correct. It might perhaps be conceived as biologically correct – an autonomic tipping point, perhaps, for the triggering of keepers. Our problem is to explain how such a threshold would come about. Pain is intrinsically unacceptable, by definition and by evolutionary design: it follows that no animal, humans included, would be programmed to accept any quantity of pain if it perceived it did not have to. In the absence of restraints, the only logical amount of pain a human would voluntarily tolerate is nil. On this basis, any degree of pain may be expected to prompt either an escape into oblivion, or the triggering of an emergency, costly keeper defence to block that escape. The inference to be drawn is that the potential for suicide would demand specific restraints to have emerged in humans, not required in other species, in order to make us motivated willingly to accept the otherwise unacceptable – to live with some burden of pain.

6.3.1 Fenders and the Evolution of Systematic Irrationality

Achieving this outcome, making humans able to tolerate the intolerable, would appear to present a major biological challenge for the design of the human psyche. It may be recalled (3.1.3) that pain and pleasure are thought to be subjectively experienced along a single hedonic continuum (Young, 1959), a unidimensional measure necessary for competing behavioural options to be weighed and motivated (Cabanac, 1979, 2010; McFarland & Sibly, 1975; McNamara & Houston, 1986).

Adaptation-level theory holds that the subjective experience of a pain on this continuum depends not on the absolute level of the pain input but on the discrepancy between the inputs past and present: in the interests of optimising signal detection, our monitoring devices reset to neutral in order to better notice future discrepancies (Helson, 1964). As the environment becomes more pleasing, the subjective benchmark used to assess its pleasurableness rises too. We live, according to Brickman and Campbell (1971), on a hedonic treadmill: any pleasure or pain gained from an event is fleeting, because people soon return to a neutral emotional set point. However, the adaptive problem of suicide implies that such a neutral set point may be unsustainable for humans: if any pain need not be tolerated because of the possibility of suicide, then any pain experienced from that position could be fatal. But such painful inputs from the environment are biologically unavoidable. For humans, life at a neutral resting point would make the individual continuously prone either to suicide or to costly keeper emergency measures required to prevent suicide.

6.3.1.1 The Homeostasis of Subjective Well-Being (SWB) above Neutral

If this analysis is correct, it suggests that a fender system would be expected to maintain the human organism at an above-neutral affective resting point. Mental health, and survival itself, would rely on the autonomic, homeostatic regulation of the individual's subjective well-being ("SWB": Cummins, 2013; Diener, 2000; Steger, 2012a; Steger, 2012b) so as to sustain a pleasantly affective position at which the individual is willing to tolerate unpleasant experiences. On this basis, there would, arguably, be a powerful fitness logic underlying the phenomenon that humans usually report feeling somewhat happy (Diener & Diener, 1996; Diener, Lucas, & Scollon, 2006) and that "life is pretty meaningful" (Davis & Hicks, 2013; Heintzelman & King, 2014) most of the time.

This maintenance of SWB would appear to involve the management, at an above-neutral state, of a cluster of affective variables, including meaning in life, purpose in life, and the possession of reasons to live. These concepts are interwoven. To have a sense of meaning in life – to have, that is, "the network of relationships that link our individual actions and goals to a broader connected purpose, defining the totality of our life," (Randles, 2014, p. 42) – may by definition be a prerequisite for feeling that life has purpose (Heisel & Flett, 2004). Meaning in life would appear to be constructed for the most part not by grand existential philosophies but by mundane, workaday preoccupations that would appear to provide the necessary motivation for people to live at all – diverse proximal reasons people hold for soldiering on in spite of adversity (Beaver, 1972; Linehan, Goodstein, Nielsen, & Chiles, 1983; Maris, 1981, 1982; von Andics, 1947).

Taken together, these connected dimensions of resilience may be viewed as a, or the, vital resource by which humans recover from even the worst hardships, sustained by what Hofstadter and Dennett (1981) call a homeostasis of the spirit. Humans appear to be equipped with complex meaning-making systems for emotional evanescence – the restoration of SWB following shocks (Gross, 2014;

Kent, Davis, & Reich, 2014; Koole, van Dillen, & Sheppes, 2011; Wilson, Gilbert, & Centerbar, 2003). The dynamic operates across a wide range of timescales. Some global rearrangements of meaning, following trauma and bereavements perhaps, may take months or years to run their course (Bonanno, 2009; Folkman, 1997; Folkman & Moskowitz, 2000; Surtees & Wainwright, 2000), but the basic component two-stage process of automatic emotional regulation, a negative affect countered with a positive, is rapid, measured in minutes or seconds – so fast indeed that it can go unnoticed (Kuhl, 2000; Lazarus, 1991; Mauss et al., 2007; Proudfit, Dunning, Foti, & Weinberg, 2014; Quirin, Bode, & Kuhl, 2011; Quirin, Kazén, & Kuhl, 2009). The process seems to operate outside of conscious appraisal, the experiential outcome being an unaccountable "I feel better, but I don't know why" (Koole & Rothermund, 2011). Emotional evanescence is, perhaps most critically, observed in the short-lived nature of suicidal crises (Barber & Miller, 2014; Gunnell & Miller, 2010). In a third of cases, acute, suicidogenic distress appears to dissipate within an hour (Drum, Brownson, Denmark, & Smith, 2009). This phenomenon may point to human affective homeostasis around an above-neutral set point conferring a powerful selective advantage. For humans, the urgency to accommodate adverse factual inputs would be motivated not merely for the sake of signal detection – implying a resetting to neutral – but by the design of a fender: the imperative to avoid the suicide danger lurking in specifically negative affect implies a need to draw the psyche back to an above-neutral point of safety.

6.3.1.2 Human Pursuits and the Need to Create Positive Experiences

Human mental health, and life itself, then, may be sustained in part by an above-neutral homeostasis of SWB, driven ultimately by the fitness demands of suicide avoidance. However, at least two problems arise from positing such a system of fender anti-suicide defences. First, useful though it may be, the maintenance of positive affect cannot be a necessary or sufficient condition for suicide avoidance. The processes that seem to keep most people's eudaemonic well-being broadly positive most of the time evidently fall short of guaranteeing to keep everyone happy and fulfilled all the time: four out of five Europeans, for example, report feeling that their lives are satisfactory and worthwhile (Eurostat, 2017), but that leaves us needing to explain how the remaining significant minority feel motivated to soldier on in spite of their misery and meaninglessness and without necessarily falling into full-blown keeper psychopathology. Presumably, another line of fender defences is in place to protect the unhappy – this matter will be discussed in Chap. 7.

Of immediate relevance is the second problem, the focus of the rest of this chapter, which is that it is unclear how SWB could be sustained, for the most part, at an above-neutral set point. Homeostatic maintenance of a non-neutral resting point would seem, on the face of it, to contradict the basic principle of adaptation-level theory. Adaptation level in psychology is the on-average series stimulus that evokes an indifferent, or neutral, response: it is the expected set point for an organism's perceptual equipment because, as was mentioned earlier, that is the level that best facilitates signal detection – it is the level that maximises the organism's ability to

detect changes (Green & Swets, 1966; Helson, 1948). To hold an organism's affect at an unnaturally warm level, one that generally evokes a positive response, metaphorically to defy gravity, would seem to imply a need for an ongoing stream of positive emotional inputs, enough to overcome the ambient inputs from the environment that would otherwise cause the affective set point to restore itself to neutral.[9]

The difficulty here is that it is not easy to see where the required positive affective inputs would come from. They are unlikely to flow spontaneously from the natural, biological environment, from the Darwinian biosphere. Viewed objectively, life as ordered by natural selection is devoid of intrinsic meaning or emotional valence (Becker, 1962/1971; Jeffery & Shackelford, 2015). William James (1902) writes that nature seems to cancel herself out, zero equalling zero, leaving nothing for a human being to feel warmth towards. Trying to extract subjective rewards from success in the biological world is like, says Slobodkin (1978), winning a game and finding nowhere outside of the game to spend the winnings. In its closed system, there is no reason to expect an organism to experience its struggle for survival as anything better than affectively neutral – that is, at adaptation level. It may be worse for humans: the Darwinian struggle to survive and reproduce, fought out in a Malthusian arena, entails the experience of unhappy conflicts on multiple fronts (Buss, 2000, 2009; Darwin, 1859/1996), a point that was discussed earlier (3.3.1). It may be our consciousness of the emotional pain intrinsic to engaging with a pitiless world of nature – the sense of loss that comes, among other things, from being a mammal (MacLean, 1990) – that is arguably at the root of the adaptive problem of suicide.

If this is true, if the positive affective experiences necessary to maintain healthy SWB are not available from the normal biological environment, then it follows that humans would have to source them from somewhere else – presumably manufactured within, or selected by, the organism. The implication is that a fender system, driven ultimately by the imperative of suicide avoidance, would be anticipated to compel the individual to select or create man-made opportunities for affective rewards. A compulsion to generate eudaemonic payoffs would operate independently of the normal biological needs of reproductive fitness, at least within the bounds of a trade-off against other calls on resources. Psychology research points to a diversity of methods used for such manufacturing of positive affect (Koole, 2009; Kuhl et al., 2015), some of which may require little in the way of resources – such as, perhaps, the practice of benefit-finding, whereby humans ameliorate the pain of adversity by selecting some countervailing upside, a silver lining for every cloud (Helgeson, Reynolds, & Tomich, 2006; Tomich & Helgeson, 2004). Others may entail significant expenditures of time and energy, as may be the case for many of the diverse reasons people give for staying alive (Linehan et al., 1983) or the sundry pursuits posited by Maris (1981, 1982) as alternatives to suicide: love, sex, work, play, family, friends, religion, art, and so on – complex behaviours selected compulsively by the individual specifically, it is argued, for the purpose of generating positive emotional

[9] The need for positive inputs would presumably intensify at times of trouble – an expectation that may be reflected in the empirical record: the human mind does seem automatically to seek out positive stimuli in response to adversities, presumably specifically to de-escalate negative affect (Koole & Rothermund, 2011; Schwager & Rothermund, 2014).

experiences. Their common feature is a disengagement from the bare processes of animal life, the urge driving them arising not directly from the minimal demands of survival and reproduction. To take one item from Maris's list, even sex, or perhaps especially sex, may be understood as a primarily recreational rather than reproductive activity – entirely so in some situations, by post-menopausal women, for example. Because such behaviours appear to be, biologically speaking, proximally superfluous, they may be hard to explain from an evolutionary perspective. They may be mistakenly deemed to be irrational: in nature, after all, not behaving at all, inaction, is the default, rational state (Cosmides & Tooby, 1994a). Disturbance generally being metabolically costly, fauna from huddling penguins to resting dogs seem disposed to do nothing in the absence of a reason to do otherwise (Ancel, Visser, Handrich, Masman, & Le Maho, 1997; Houston, Prosser, & Sans, 2012). But creative and recreational activity – a kind of extraordinary Darwinian inducement with which the human psyche's consent is obtained for its continued existence – may be a necessary condition for the human organism's viability. The survive-and-reproduce law of natural selection generating this phenomenon may follow an algorithm, unique to the human species, that as long as the organism's mind judges its life on balance to be affectively worthwhile, and therefore agrees to survive, then at least the possibility remains that its other evolved systems may lead it to reproduce.

Human thriving, indeed survival according to this conception, would seem to require more than the organism to work through a list of priorities in the style suggested by Maslow's (1943) famous hierarchy – beginning with physiological needs and ending with psychological. It may be, to echo Seager (2012), that Maslow's hierarchy is upside-down: rather, a global psychological motivation needs to be in place first, sufficient for the mature human even to take on the task of satisfying other biological demands. Without this motivation, at perhaps any point in the hierarchy, the human individual faces, if not suicide, and then becoming overwhelmed by psychopathological keeper blocks against suicide. Maslow himself, late in life, concluded that his hierarchy may be insufficient, observing that even "fully self-actualized" people can find their lives pathologically purposeless even though all their biological needs have supposedly been met (Thorne, 2012). At the other end of the hierarchy, explaining how humans managed to avoid suicide even in the deprivations of the Auschwitz death camp, Frankl (1946/2011) offers Nietzsche's aphorism: "He who has a why to live can bear almost any how."

So the vital function in human affairs of what may appear to be inconsequential and arbitrary loves, passions, and preoccupations may be understood in the light of this expected design of an emotional reward-creating fender. It might explain the apparently paradoxical outcome of human trivial pursuits, an evolutionary oddity observed by Pinker (1997, p. 521): "People everywhere spend as much time as they can afford on activities that, in the struggle to survive and reproduce, seem pointless." Such interests, or at least the promise of such interests, that furnish the organism with hope, joy, meaning, and other forms of emotional counterweight to the experiencing of pain, appear not only to sustain happiness (Layard, 2011) but to be matters literally of life and death – the primary basis for the individual's choice of whether to live or die (Frankl, 1946/2011; Meyer, Irani, Hermes, & Yung, 2017; von

Andics, 1947). What makes life worth-living, argues Humphrey (2018), is "some newly evolved appetite for staying alive." Pointing to the possible source of this appetite, a fender mechanism, driving the individual to select affective reasons to live, and answering the fitness imperative to avoid suicide, could constitute a, or perhaps the, superordinate force driving much of human day-to-day affairs.

6.3.2 Fender Defences and the Fitness Value of Organised Misbelief

The task of maintaining affect at an unrealistically positive emotional resting point, based on inputs of rewarding experiences that are detached from the normal demands of the real biological world, would seem to imply the necessity of a further fender system that can sustain self-serving misbelief. The design objective of a fender system could be stated as the maintenance over a lifetime of a measured, selective, continuous non-acceptance of objective reality and, in place of reality, the expectation and provision of a continuous flow of subjectively rewarding perceptions. The individual would need to perceive the world, and self-in-the-world, as benign – to believe that it offers somewhat greater prospects for emotional rewards than would be expected to arise from the unaided laws of physics and nature, that the natural world is not entirely red in tooth and claw. This misbelief would have to be held in spite of the resulting systematic failures of prediction – repeated and, in fitness terms, costly, discrepancies in which organism's encounters with the real world continually disappoint. In other words, a belief that the world, and one's life in the world, can be relied upon to provide a basis for SWB would have to be maintained in the face of an ongoing newsfeed of evidence to the contrary. As a specification for a fender, this design objective would appear to present a profound evolutionary challenge: the human animal must operate in the real world in order to survive, as is true of any organism, but at the same time the human has to remain systematically, tactically, and psychologically, removed from the real world in order to live with the potential for suicide.

A tentative proposal can be offered as to how such a semi-detached state might be achieved and supported. Sustained misbelief, at this global level, would seem to require the individual to hold in the psyche an idealised model of self- in-the-world, a stable, supernatural Kuhnian paradigm, which endures, at least for the time being, because it meets minimum criteria of acceptability – even though there might be other plausible, but mutually incompatible, candidate paradigms available to choose from (Kuhn, 1977). The real world would be perceived not directly but through the lens of the selected paradigm: incoming facts would be previewed for their emotional threat, compared against the paradigm for their goodness of fit, and edited as required to conform to the model's tenets before being admitted into conscious processing. The narrative content of the paradigm would not particularly matter – it could be largely arbitrary in its detail. What would vitally matter is that the paradigm (a) provides a supply of emotional rewards sufficient for the individual safely to

sustain SWB and (b) is capable of being defended from daily attack from potentially disillusioning factual updates. Within this selected, tactically illusory worldview, the individual could live for the most part immune both from suicide and from the keeper defences required to block suicide.

Aside from its postulated evolutionary origins – the notion that such extra-terrestrial mental models may be manifestations of a system of fenders – this proposal connects with a familiar idea in the brain and behavioural sciences. Several researchers have developed empirically supported theories of cognition and emotional defence based on the observation that people deal with loss, trauma, and other painful encounters with the world using basic, and self-servingly inaccurate, assumptive frameworks (Bowlby, 1969/1997; Epstein, 1994; Janoff-Bulman, 1989; Janoff-Bulman & Yopyk, 2004; Parkes & Prigerson, 2010). What it is added here is the proposal that the fitness threat of suicide may constitute an, or the, ultimate motor for the evolution of a systematically overoptimistic belief system. A fender would require the world to be viewed as more rewarding, and predictably more rewarding, than could be substantiated by objective evidence. If humans did not have pain-moderating, SWB-promoting, paradigmatic worldviews to inhabit and defend, it is difficult to see how the measuredly, unrealistically optimistic stance required to avoid suicidality and psychiatric problems, according to this book's thesis, could be sustained in the face of inevitable painful life experiences.

To make a parenthetic point, effective, benign, unrealistically overoptimistic, fender-induced worldviews could paradoxically be cruel. A paradigm that, say, one's life is damned by angry gods assumes at least there are gods and that they are not indifferent to one's existence – and it implies they might somehow be assuaged: as Parkes and Prigerson (2010, p. 96) note, it is "easier to believe that fate is malevolent than to acknowledge our helplessness in the face of events." For the same reason, a belief system that holds oneself to be unrealistically responsible when things go wrong – personally to blame for bereavements and traumatic experiences, for example – may provide the minimal, but life-preserving, emotional comfort that the world is not unpredictable and meaningless, that it offers at least some hope of personal control (Bolton & Hill, 1996; Parkes & Prigerson, 2010).

6.3.2.1 Fender Defences and the Evolution of Encultured Worldviews

While it would be presumably possible for effective paradigmatic worldviews to be built and maintained independently by individuals, as self-sufficient stand-alone ventures, they might be difficult and risky single-handedly to defend. The stakes are high: to reiterate, in the presence of the ever-present fitness threat of suicide, successful defence of a fender worldview could be viewed as a human biological necessity. Failure of the system could have catastrophic fitness repercussions: a single item of falsifying evidence as disproof (Popper, 1935/2002) could be enough to dissolve the belief system on which, according to this model, the individual's mental health, if not survival, depends. It would not be surprising, as the neurology suggests, that the brain registers threats to deeply held beliefs using much the same

neural tracks as it responds to physical threats (Kaplan, Gimbel, & Harris, 2016). Given that the selection of the storyline detail of a fender paradigm is of secondary importance to its primary need for defensibility, there could be little to lose, but much to gain, from adopting wholesale whatever fender paradigm happened to prevail in the cultural environment. On a communal basis, individuals' SSSD, and the psychodynamic defences needed to meet emotionally painful factual attacks, could, in effect, be pooled – the task of denying, accommodating, dismissing, or otherwise modifying incongruent updates could be shared among members of a like-minded group. Growth of the belief group could be presumed itself to provide further reassurance that the belief system is robust: as Festinger, Riecken, and Schachter (1956, p. 28) put it, "If more and more people can be persuaded that the system of belief is correct, then clearly it must, after all, be correct."

If this proposal is correct, then the imperative to avoid suicide may offer a powerful evolutionary drive towards the adoption and maintenance of social worldviews, of the kind that may be defined as "humanly created and transmitted beliefs about the nature of reality shared by groups and individuals" (Greenberg, Solomon, & Pyszczynski, 1997, p. 65). Some communal belief systems, largely arbitrary in their detail, culturally transmitted, and strongly defended, would as their primary function enable the individual to perceive self in the world as a generally emotionally rewarding experience and more rewarding than factual reality would justify. Critically, for a worldview to fulfil its fender function, instinct blindness would apply (Cosmides & Tooby, 1994b): it would need to be accepted by its adherents not as a view but as a universal truth. As there may be doxastic value to a worldview's believers in its perceived popularity, it may be assumed to be more universally accepted than is actually the case (Ross, Greene, & House, 1977). While objectively partly delusional, such belief systems would expectably result in better mental health for their participants, because a reduced susceptibility to suicidogenic mental pain would lessen the need for keeper psychopathological defences to activate.

6.3.2.2 Suicide, Mental Health, and the Evolution of Religion

The above argument could connect the demands of controlling suicidality to the long-observed and, on average benign, psychological effect of spiritual and religious belief (Cook, Powell, & Sims, 2009; Myers, 2000; Pearce, Rivinoja, & Koenig, 2008; Vaillant, 2013). Most reliable studies show, to varying degrees, that religiosity is associated with better mental health and fewer suicidal thoughts and behaviours (Bonelli & Koenig, 2013; Koenig, King, & Carson, 2012; Lester, 2017), but how it is that religiosity so protects remains unresolved. Stack and Kposowa (2011) review four of the more widely accepted, mainly sociological, theories posited to reduced suicidality among the religious: that a religion's sheer breadth of shared beliefs and practices may protectively integrate their followers; that a few core creeds, common to many religions, confer the safeguard – such as belief in an afterlife; that religions may provide social networks and support; and that they might establish a moral framework for the wider community with the effect of restraining deviant

behaviour, suicidality included. The authors' cross-national meta-review suggests correlational support exists for all four ideas, which may anyway conceptually overlap. None of these accounts, on the face of it, would conflict with the ultimate, evolutionary causation posited here, that religion may perform an anodyne, anti-suicide function. But by whatever precise route religious adherence averts suicide, if communities gain competitively from less suicidality, and by inference from reduced psychopathology, then the universality of religion may plausibly have come about as matter of group selection (Sober & Wilson, 1998): groups that nurtured SWB-promoting communal creeds, benefiting from better mental health and reduced suicidality, would expectably out-reproduce those that did not.

The origin of religion has long puzzled psychologists (Freud, 1907/1959; James, 1902) and has proved particularly difficult to explain from an evolutionary perspective. While (as the model proposed here would anticipate) particular religious conversions almost always tend to follow the ambient community's beliefs (Sagan, 2006), religiosity in general is apparently ubiquitous across human societies (Brown, 1991; Kluckhohn, 1962). This and other universally identifiable patterns may point to religiosity's evolutionary roots. The curiosity is that in fitness terms, religion is costly: it consumes time and material resources but apparently confers no apparent adaptive benefit that justifies the expense, according to many observers (Boyer, 2000; Dawkins, 2006; Dennett, 2006; Schloss & Murray, 2009; van Inwagen, 2009). D. S. Wilson (2010) identifies and examines five main evolutionary explanations for religiosity:

- Religions may spread like parasitic infestations, exploiting a species-universal vulnerability in the human mind.
- Religions may spread by process of group selection, promoting pro-social, cooperative behaviours.
- Religions may be products of in-group competition, structures by which social winners can maintain control over losers.
- They may be a non-adaptive by-product of some as yet unidentified adaptation.
- They may be fossils — obsolete residues of some adaptive benefit from the past.

A consensus, at least among the more vocal evolutionary theorists who have considered the matter, seems to favour the first of these accounts: that religion is probably not itself adaptive but is more likely to have emerged as a costly by-product of human cognitive systems that are, overall, adaptive despite the cost (Liddle, Bush, & Shackelford, 2011; Schloss & Murray, 2009). The human mind, it is argued, is wired to perceive evidence of active agents and intended purpose in the world – a default teleological stance that for the most part aids survival but which also opens up a psychological vulnerability that imaginary divine agents can exploit (Bering, 2003; Bloom, 2009; Boyer, 2008; Boyer & Bergstrom, 2008; Dawkins, 2006; Kelemen, 1999; Sedikides, 2010). The evidentiary burden of this by-product hypothesis is, however, onerous (Powell & Clarke, 2012): it requires, among other things, an explanation as to why natural selection has apparently failed to respond to the heavy, recurring, supposedly pointless, fitness cost of religion by promoting the kind of dynamic fightbacks that are normally seen in host-parasite tugs of war.

The paucity of countermeasures could be viewed as an unaccountable omission given nature's ingenuity in responding to parasitism elsewhere (Dawkins, 1982, 2009). Wilson himself, while accepting that all five hypotheses may have some validity, prefers the second, group selection argument; that because religions promote social cohesion (Durkheim, 1912/1995), communities with stronger religious adherence can be expected to outcompete those with lesser, resulting in a near universality of religiosity (Wilson, 2010). A criticism of this account, as Wilson acknowledges (2007), is that religions are far from mere vehicles for promoting cooperation. It is possible to think of many non-religious social structures which could serve that organisational purpose if that was the only purpose to be served. What remains unexplained is the power and intensity of the personal encounter with the supernatural, the central place of the divine in the spiritual experience of religion and in the kind of a calling which may be heard independently of, and pursued in outright defiance of, the demands of a community (James, 1902). As Wilson puts it, religious belief is not just a question of "Is there anyone out there?," but also an integral and insistent "Is there anyone up there?" (Wilson, 2007).

6.3.2.3 The God Idea and True Altruism

The fender framework may offer some insight into this essential spiritual content of religious belief: God(s), as an idea in its many forms, may be understood as a pain-type fender – a paradigmatic worldview which enables the individual to perceive that something, somewhere cares about his or her condition and that happiness is more in prospect than would be expected under the unassisted workings of the natural and physical world. God may be synonymous with goodness: in biblical terms, God is love (1 John 4:8, 4:16) – "He is not merely benevolent, he is benevolence itself" (Barnes, 1850, p. 375). God(s) may be conceived as the conceptual embodiment of a set of overall benign values that guide the world and its people, a moral order that is partly detached from the usual amoral algorithms of inclusive fitness. In a godly world, driven by such divine values as compassion, forgiveness, and charity, the individual's life may be sustainably deemed to be worth living in spite of the inevitability of suffering: we have more to look forward to than a dog-eat-dog existence. There would be evolutionary logic, then, in Jung's conception of God as a primordial psychological archetype, one that emerged with origination of the modern human psyche: God may be conceived as a conceptual blueprint that forms part of the universal mental equipment of our species, and which may instantiate in diverse manifestations according to local cultural climates (Jung, 1933/2010, 1962/1963; Stevens, 2002). This pragmatic, evolutionary, Jungian view of God as an inner resource that is innate to the human psyche may be visible in the non-denominational – and psychotherapeutically effective (Galanter & Kaskutas, 2008) – text of Alcoholics Anonymous (2001, p. 55):

> …deep down in every man, woman, and child, is the fundamental idea of God. It may be obscured by calamity, by pomp, by worship of other things, but in some form or other it is

> there. For faith in a Power greater than ourselves, and miraculous demonstrations of that power in human lives, are facts as old as man himself.
>
> We finally saw that faith in some kind of God was a part of our make-up, just as much as the feeling we have for a friend. Sometimes we had to search fearlessly, but He was there. He was as much a fact as we were. We found the Great Reality deep down within us. In the last analysis it is only there that He may be found. It was so with us.

By this scheme, as is the case for other pain-type fenders, God's biological function is proximally to promote the organism's sense of eudaemonic well-being and thereby to maintain mental health – to forestall the need to activate psychopathological keeper anti-suicide measures – and ultimately to avoid suicide. The effectiveness of the God idea would arise primarily from its doxastic content: it is the inner, intrinsic, experiential faith, rather than mere outward demonstrations of godly behaviour, that may offer a basis for sane living (Lester, 2017).

Nonetheless, behaviours and beliefs have to tally: one would not ordinarily or survivably believe oneself to be in one scenario, climbing a tree, say, while behaving in a way that is incongruent with that belief – by acting, say, as if one is taking a bath. If one is to believe that the world and its people are, generally, caring, compassionate, and good, and if one identifies oneself as part of that world and as one of its people, then one's own actions would expectably be consistent with that belief system. By this perspective, psychological well-being may be manifest in large part by the individual's own willingness to live virtuously – to offer to others the same selfless love, charity, and forgiveness that one would hope to receive for oneself. It would be normal, on this basis, for people to donate anonymously to charities, champion distant political causes, commit to humanitarian relief work, tend to the terminally ill, do kind acts for strangers, care for pets and plants, and so on – to give, in other words, in situations where there is evidently no possibility of payback by any route, or even any competitive advantage to be gained for the actor's community. Human beings have a capacity for generosity, on this basis, that reaches beyond the "reciprocal altruism" proposed by Trivers (1971) – a style of giving reliant on the principle of "I'll scratch your back if you scratch mine," and it also goes beyond the prosocial behaviours that may promote the interests of one's group (Sober & Wilson, 1998). There need be no transactional return, direct or indirect, for the self or the group, in fender-induced acts of altruism, because the behaviour would not be motivated for what might be gained in return. True altruism would, rather, constitute an epiphenomenon, arising spontaneously from the actor's adaptively benign worldview. The psychological benefit to the self, obtained whether or not others actually benefit and whether or not others even notice, stems not from the behaviours themselves but from the belief system from which such behaviours would implicitly emanate. If the impulse to give unconditional love in this way has biological, adaptive roots, then Desmond Tutu may be right that humans are "hard-wired for goodness" (Dalai Lama, Tutu, & Abrams, 2016).

So, tentatively, it might be suggested that a fender system could furnish missing evolutionary logic for implicit religiosity and true altruism, the adaptive advantage residing in the effect of a benign worldview in countering emotional pain, thereby suppressing suicidality and psychopathology. The severe fitness threat of intentional

self-killing, and the organism's costly final defences against suicide in states of extreme emotional pain (keepers), might be expected to promote the cultural spread and maintenance of religious worldviews and an urge for unconditional giving, despite the expense. Not to need religion or spirituality could be seen, from this angle, as a luxury available to people living in safer, more comfortable environments, subject to a lesser threat from potentially suicidogenic or psychopathogenic adversities (Liddle, 2015; Watts, 2007). For the rest, religion may offer a vision of what makes life worthwhile in the face of hardship (Dennett, 1995): religion may have evolved not to parasitise the human psyche but as a form of what Jung (1933/2010) calls psychic hygiene.

6.4 Summary and Conclusions

The picture built up in this chapter is that the evolution by natural selection of a complex of psychological and cultural devices, involving multiple trade-offs of fitness costs, may have enabled human beings to moderate and voluntarily bear the aversive experience of pain. A system of frontline, anti-suicide evolved psychological mechanisms (fenders) would expectably have been favoured to meet the adaptive problem not of suicide itself but of the costly emergency responses that would activate as a last line of defences (keepers) against suicide – the psychopathological symptoms that arguably constitute the organism's last-ditch efforts to make suicide unnecessary and/or to block the planning and attempting of actual self-killing.

This chapter has proposed four broad forms of pain-type fenders. First, SSSD screens incoming information for its emotional content and selectively modifies or sequesters painful information before it reaches consciousness, a down-modulation of the experiencing of aversive inputs that may characterise diverse psychodynamic defences. Second, a heavy and continual engagement in what may be seen as biologically frivolous interests, preoccupations, and sundry pursuits which, while serving no direct purpose in the struggle to survive and reproduce, may provide life-preserving emotional counterweights to the experiencing of pain. This flow of affective rewards may enable SWB to be sustained even in the contexts of painful life circumstances. Third, coordinating systems would be charged with the business of maintaining SWB at a mildly, but artificially, warm resting point. Homeostasis of affect at, crucially, an above-neutral set point, creates a buffer zone of SWB within which painful realities may be experienced without danger of suicide: this pain management system is perhaps responsible for the existence of a tolerable threshold, "a certain critical line somewhere in the mind" (Shneidman, 1998, p. 248) below which painful experiences may be suffered without great disruption to the organism's general functioning. The entire framework would be sustained by, fourth, the maintenance of an unrealistically benign paradigm of the self's life in the world — a generally comforting, meaningful outlook whose design objective is to enable potentially suicidogenic factual inputs to be tactically disregarded. This virtual reality may often be acquired and defended as an encultured religious belief system and feature some idea of Gods. If this analysis is correct, adherence to religious

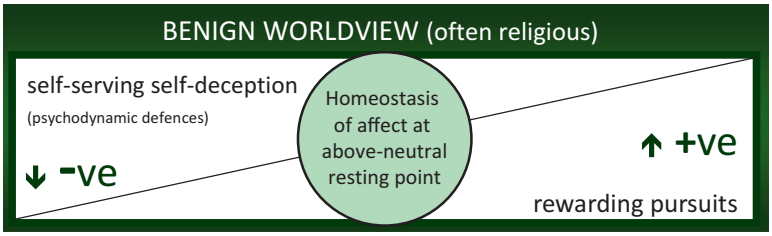

Fig. 6.1 A posited nesting of pain-type fender defences. SSSD, and engagement in rewarding pursuits, may be understood to suppress negative affect and stimulate positive affect respectively, their operations coordinated by systems maintaining homeostasis of affect at a mildly positive set point. The whole machinery, subsumed within a benign self-in-the-world paradigm, often religious, may be informed by and deployed to defend that optimistic worldview

beliefs may function to shield the individual from mental ill health and suicidality by means of stable, rose-tinted glasses through which reality can be perceived and experienced in a safely censored form.[10]

Figure 6.1 offers a simple, tentative, schematic to suggest how these four components may nest. A system managing the homeostasis of SWB, seeking to maintain an above-neutral affective set point, would presumably take on a central coordinating role, manipulating the experiencing of affect as current emotional states and demands require. SSSD and rewarding pursuits would seem to constitute two main tools by which an artificially warm affect may be obtained: SSSD acting to moderate the experiencing of negative affect, while non-biological loves and passions generate positive affect. These two systems (🡻−ve/🡹+ve) are shown in Fig. 6.1 as reciprocating wedges, to indicate that they might be anticipated to work partly interchangeably: less of one implies a need for more of the other and vice versa. Globally managing the arrangement would be the benign worldview, which sets paradigmatic, optimistic benchmarks for the subsystems to assess informational inputs against and which recruits the subsystems for its continued defence.

Pain-type fenders can be viewed as biological devices designed to induce the commonplace that Kluckhohn (1962, p. 299) describes as so universal that it is all but invisible: "Man wants to live and to enjoy living." But not everyone apparently does, in fact, enjoy living (Eurostat, 2017); how are they kept from suicide, without being plunged into full-blown psychopathology?

The evolutionary puzzle of suicide, as at the end of this chapter, may be summed by Fig. 6.2. While pain-type fenders may be expected to keep most people feeling that life is worthwhile most of the time, they cannot eliminate pain, as a biological necessity, altogether. A further line of defences would expectably be found to enable painful situations to be endured without the organism resorting either to suicide or to last-ditch keeper defences to stop suicide. On the "brain" side of the "pain and brain" model of suicide, other fender defences may deny the intellectual means of suicide even from those who may have the affective motivation, as will be discussed in the next chapter.

[10] It may be relevant that neuroimaging associations have been found to connect psychopathology, religious belief, and defences against threats (Flannelly & Galek, 2010).

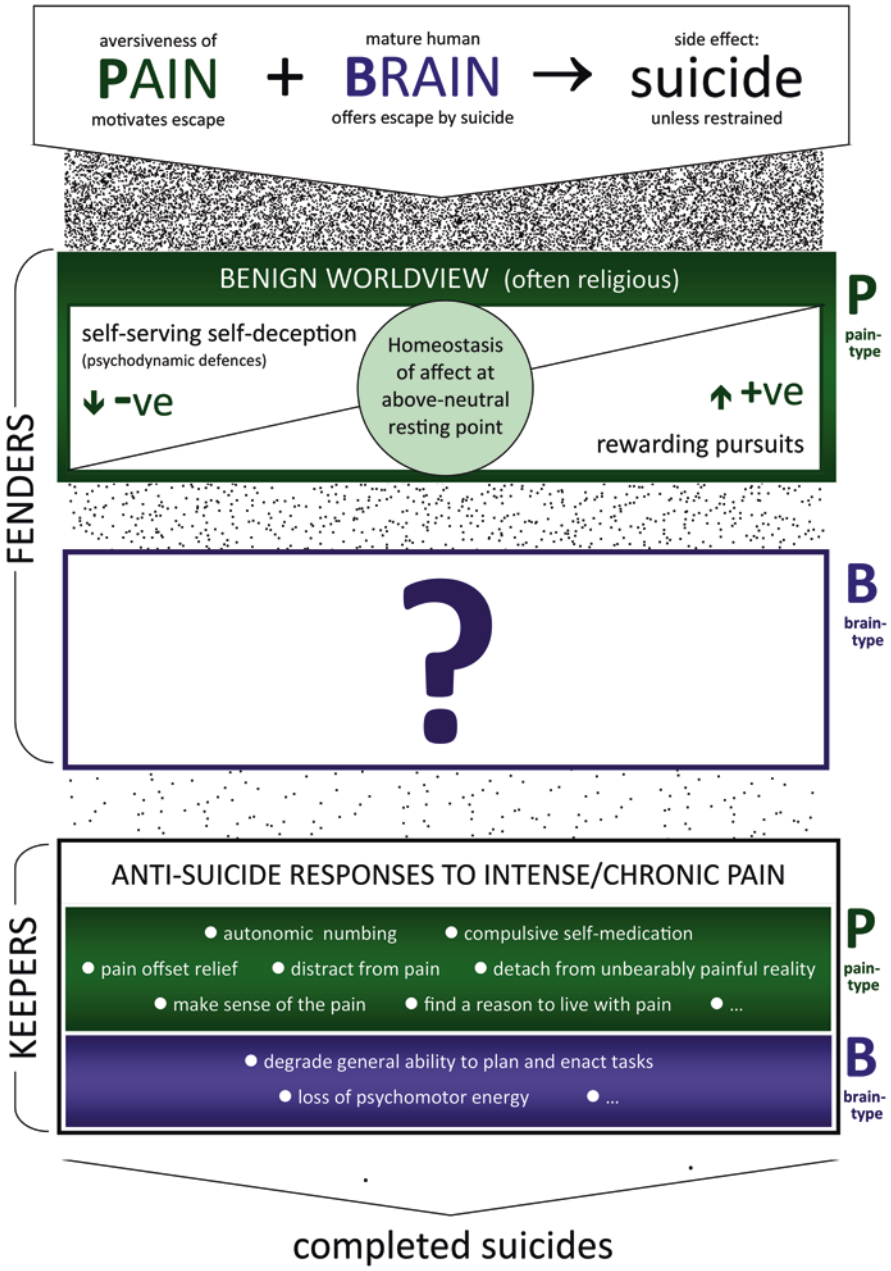

Fig. 6.2 A further brain-type fender system may be expected to protect those who, despite the operation of pain-type fenders, experience a loss of subjective well-being, without necessitating the extreme emergency measures of keepers

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Chapter 7
"Brain-Type Fenders": Restricting Access to the Suicide Idea

Far away is far away only if you don't go there.
– George Otis (1953-)

By the model proposed in earlier chapters, emotional pain provides the motivation for suicide, and the intellect of the mature human brain provides the means. These "pain and brain" factors may constitute not only twin evolutionary causes of suicide but also, by the same token, twin levers which natural selection would be expected to use to stop humans using self-killing to escape from pain. Working ahead of a posited last line of reactive anti-suicide defences (keepers), a first line of defences (fenders) would expectably operate, including a system of pain-type fenders discussed in the preceding chapter. Pain-type fenders, it was argued, could be expected to be manifest in the self-serving self-deception (SSSD) that characterises psychodynamic defences; a homeostasis of affect at above-neutral set point; the compulsive pursuit of pleasurable activities independently of the direct demands of survival and reproduction; and the adoption of religious beliefs to assist with the retention of anodyne, benign paradigms of the world. The common goal of these devices would be to regulate the "pain" component of suicide's proximal causation for the purpose, not directly to prevent suicide, but to avoid the cost of activating emergency anti-suicide defences, keepers, which, it is argued, instantiate as diverse symptoms of common mental disorders (CMDs).

Pain-type fenders are conceived to manage the experiencing of affect by a balancing of fitness costs – avoiding the psychache that would trigger keepers, while allowing the organism still to experience enough pain effectively to navigate its environment. Therein lies their limitation: pain-type fenders could be only an imperfect solution to the human problem of tolerating pain. They would be expected to keep most people adequately happy most of the time, and they would be expected to create an above-zero threshold of tolerance below which aversive stimuli may be accommodated with little or no disruption; but fenders could not be expected to keep the individual permanently and continuously free of pain. Some experience of pain may be inevitable: most people can expect to experience at least one potentially traumatic event in their lives, for example, a tragic death, an assault, a violent

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accident, and so on (Norris, 1992). The experiencing of emotional pain may also be fitness-enhancing, as was argued in Chap. 3 (3.1.2): a patterned post-traumatic stress response may signal adaptive value in that response – a biological call for the human organism to reassess its meaning systems perhaps (Park, 2013; Park & Slattery, 2014). If it is not desirable for reproductive fitness that pain-type fenders should suppress pain altogether, then it implies a lethally dangerous gap in human anti-suicide defences. But there is no evidence of such a gap in practice: common experience is that many of us, perhaps a fifth (Eurostat, 2017), are enduring periods of unhappiness and overall dissatisfaction with our lives, and we do not necessarily fall prey to suicide or obvious psychopathology. This gap is presumably filled by other protective measures.

What enables people willingly to endure this residual discomfort? The "pain and brain" evolutionary model of suicide proposed in earlier chapters may point the way: having explored the anti-suicide potential of pain- and brain-type keepers (the last-line defences of psychopathology, Chaps. 4 and 5) and pain-type fenders (front-line defences, managing the experiencing of potentially suicidogenic pain, Chap. 6), we are left, by elimination, to seek the answer in brain-type fenders. As frontline defences, brain-type fenders may be expected to act as pre-emptive rather than reactive blocks against suicide as a cognitively available option, independently of the individual's emotional state. So, whether or not the individual feels any motivation to suicide, and whether or not the individual's pain has escalated to the extent that keeper defences have activated, brain-type fenders would aim to make suicide mentally impracticable, just in case. This chapter will argue that such mechanisms are most likely to have evolved with the aid of cultural prohibitions against the idea of suicide.

7.1 The Idea of Suicide as the Target for Brain-Type Fenders

The adaptive design challenge for brain-type fenders can be presumed to entail another balancing of fitness costs. The objective would be to eliminate, as far as possible, the intellectual availability of self-killing as a means of escaping pain; while leaving untouched, as far as possible, the individual's general capacity to imagine, reason logically, plan, and otherwise use the sophisticated intelligence that is thought to have adapted the human organism to its cognitive niche (Pinker, 2010; Tooby & DeVore, 1987). In this respect, brain-type fenders would be distinct from brain-type keepers, which, for the purpose of thwarting an actual suicide endeavour, would attenuate these general intellectual capacities, a point that warrants further exploration.

The fitness cost of suicide, on one side, would seem to be severe (1.3), but the consequences of degrading the organism's general intellect may also be grave. As was discussed in Chap. 3 (3.3.2), human sapience can be inferred to confer significant adaptive value from the scale of the costs borne for its sake: these costs include the mechanical dangers of birthing large-skulled infants (Wells, DeSilva, &

Stock, 2012); the metabolic burden of an enlarged brain (Campbell, 2010; Miller, 2007); the investment in protracted childhoods while the brain matures (Flinn, Quinlan, Ward, & Coe, 2007; Geary, 2005; Kaplan & Lancaster, 2003); the nutritional costs of sustaining the brain organ (Aiello & Wheeler, 1995); the cost of bearing its genetic mutational load (Keller & Miller, 2006); problems of thermoregulation (Falk, 1990); and, so this study proposes, suicide. A general attenuation of this high-order cognitive functioning may be highly effective at preventing suicide – hence, as was argued earlier, the triggering of certain symptoms of major depression, addictions, psychoses, and other keepers. But such general mental degradations would offer a fitness gain only as a crisis intervention: there would be little or no fitness advantage in keeping an individual's intellect permanently so severely disabled that suicide is impossible, just in case a suicidal crisis might arise, because such a retardation would be self-defeating in an environment where the individual must compete with mentally mature adults for mates and other resources. There may be little anti-suicide advantage in half measures either, because there may be no mild level of intellectual impairment that would usefully prevent a suicidal act being performed: there is little epidemiological evidence that, at least above a minimal threshold, below-average intelligence has any protective effect (3.2.4) (Gunnell, Magnusson, & Rasmussen, 2005). On the other hand, even a slight reduction of intellectual functioning would expectably incur a significant fitness disadvantage in weakening the individual's ability to compete for resources: intelligence is said to play not only a functional role in human fitness, via in the resources it can get directly, but arguably also a decorative one, as a signal to prospective mates of an individual's generally good genetic condition (Miller, 2000; Penke, Denissen, & Miller, 2007; Stone, Shackelford, & Buss, 2012).

7.1.1 Suicide and the Disgust Mechanism

If an opportunity exists pre-emptively to prevent suicide via the brain component of a pain-and-brain model of suicide's evolutionary a etiology, without impairing general intellectual or behavioural performance, then it would presumably lie in attacking not cognitive functions generally but suicide specifically as a thought or behavioural option. On this basis, one or more fenders might be expected to have as their design objectives (a) to make the suicide idea, and only the suicide idea, unthinkable and (b), if suicide is thinkable, then that behaviour, and only that behaviour, unattractive. Perhaps an outcome this precise might be achieved by the brain being programmed genetically to have difficulty thinking about suicide as a concept. It is hard to see, though, what conceptual component of the suicide idea would constitute an informational cue specific enough for natural selection to respond to: specialists working in the field find the concept so nuanced and multifaceted that a consensus definition eludes even them (Silverman, 2013). To return to a point raised in Chap. 4 (4.3.1 above), there is no evidence that the brain can read and respond to

the semantic, narrative contents of thoughts anyway – rather, the brain responds to emotional associations (MacLean, 1990): a conceptual thought would contain little for the autonomic nervous system to act upon, unless and until it carried with it some emotional content. If the brain is selectively to resist the suicide idea, then, an intervening step would be required, to tag the idea with an aversive emotional message.

So, an aversion towards the specific thought of suicide is unlikely to evolve by genetic natural selection alone, but it could be acquired, contingent on the individual learning an aversive emotional association. The general mechanics of this class of learning apparently are innate: moral prohibitions generally are posited to exploit the neurological faculty of disgust – an ancient mechanism believed to have evolved in response to the prototypical sights and smells that predicted the threat of contaminants, and likely to have been co-opted in humans for the task of guiding social and moral choices (Curtis & Biran, 2001; Pizarro, Inbar, & Helion, 2011; Rozin, Haidt, & McCauley, 2008; Tybur, Lieberman, Kurzban, & DeScioli, 2013). Learning is required for the emotion of disgust to activate: if and only if the ambient culture presents a forbiddance, then forbiddance is the emotional response most of its novices will most readily adopt. Hence, to illustrate, human infants are not innately disgusted by faeces, but in time children usually come to be spontaneously disgusted by certain stimuli, faeces included, which they learn are disgusting to others. This kind of integrated genetic-cultural dynamic is not unusual – many evolved psychological mechanisms require some level of culturally sourced inputs for their proper functioning (Buss, 1995; Tooby & Cosmides, 1992).

7.1.2 Suicide, Incest, and Prepared Learning

Disgust can be understood as a "moralising emotion," invoked by behaviours that are already normatively proscribed (Pizarro et al., 2011). The outcome may be moral certainties that may look and feel innate but which may be explained rather by the workings of open affective systems operating in accordance with a generalised "moral grammar" (Nichols, 2005). A parallel to suicide might be found in attitudes towards incest, a practice that usually inflicts fitness handicaps on those who do it in the form of inbreeding depression – the loss of fitness caused to offspring by the heightened risk of inheriting a double dose of harmful, recessive genetic mutations. In societies which proscribe at least some forms incest – that is, virtually all of them (Murdock, 1949) – their members intuitively "just see" without argument that sibling incest is wrong and are perplexed if asked to give their reasons (Haidt, 2001, 2008). However, it seems that, in the absence of a taboo, sibling incest may be tolerated as an unremarkable behaviour, as appears to have been the (very rare) case of Roman Egypt (Hopkins, 1980; Scheidel, 2005). Such a system builds in flexibility for the organism to adjust to exceptional circumstances. Inbreeding may not in fact be fitness-damaging under absolutely all conditions: alongside the risks there are also payoffs, and there may be times, for a small, isolated group, for example, or in the absence of better mates to choose from, when inbreeding may be the best or only genetic strategy available (Lieberman & Smith, 2012; Wolf, 2014).

Incest makes an imperfect analogy for suicide: unlike incest, and as Chap. 2 concluded, the intentional cessation of one's own consciousness *per se* is unlikely ever to be fitness-promoting (2.2). It may be, in combat situations perhaps, that heroically self-endangering behaviour is sometimes adaptive or the least worst option available (Smirnov, Arrow, Kennett, & Orbell, 2007): if so, risking self-harm might not be absolutely precluded, while suicide – the intentional termination of one's own consciousness – probably would be. The utility of the incest/suicide comparison is that the moralities of both incest and suicide may be understood not as an innate givens but as domains of a biological preparedness for learning. They may be analogous in turn to the special sensitivity with which our minds seem attuned to acquire phobias of snakes and spiders (Seligman, 1971). What self-harm, inbreeding depression, and dangerous animals have in common is that they may constitute a class of severe, but locally contingent, fitness threats – threats that our ancestors would have recurringly faced in general terms over evolutionary history, the exact specifics of which were best learned from the prevailing collective wisdom (Barrett, 2005; Cummins & Cummins, 1999; Feldman & Laland, 1996; Fessler & Machery, 2012).

Applying this principle to the specification of a brain-type fender, and given the severe fitness danger of suicide, it could reasonably be expected that an anti-suicide morality, a neurological disgust, would emerge and spread strongly by cultural transmission across the generations. This culturally driven protection may be inferred from the epidemiological record: the suicide rates seen among migrants reflect the rates typical in their cultures of origin rather than rates in the host country and only gradually move towards conformity with the host's cultural norm (Spallek et al., 2014). The enduring, patterned variations in suicide rates between nations seem primarily to reflect differences in attitudes – the strength of the community's view of the act's unacceptability (Schmidtke, 1997).

7.1.3 The Suicide Taboo as a Brain-Type Fender

A question arises as to how an anti-suicide sentiment would transmit itself. A plausible explanation lies in Gilbert's (2006) notion of a "super-replicator": he argues that certain cultural ideas can be self-replicating, passed across generations because a society that held the opposite idea would deplete itself of descendants to transmit it to. Gilbert cites as an example the widely held, but possibly mythical, assumption (A) that having children will make you happy. Some research evidence suggests the reality is rather (B) that people are usually happier if they are not raising children (Twenge, Campbell, & Foster, 2003); but a society that believed B and acted accordingly, regardless of B's actual veracity, would eventually be outbred by a society that believed A. The moral certainty that suicide is wrong might readily replicate itself in the same way: if people who believed suicide to be an admirable means to escape pain acted on their own convictions, then their belief-transmission network would be expected rapidly to self-destruct, thereby "terminating the belief that terminated them" (Gilbert, 2006, p. 222). On the grounds that a group nurturing

self-destructive beliefs would contain the seeds of its own elimination, to be outpersisted by groups with more fertile belief systems, a powerful, culturally driven aversion to suicide would expectably prevail across most societies most of the time (Chudek & Henrich, 2011; Sober & Wilson, 1998).

If this model is correct, then a near universal stricture against suicide might be understood to arise from two combined pressures: first, as the sum of individual urges, as Freud (1913/1985) argues of the incest taboo, on the grounds that societal prohibitions can be presumed to belie the latency of the behaviour in its members (there would be no need to prohibit something that people were not tempted to do in any event), and second, the taboo's collective, social utility, in line with a cultural materialist explanation (Harris, 2001). In other words, the collective interests of the societal unit, and the genetic fitness of its individual members, would expectably align, working together to transmit a powerful prohibition against intentional self-killing.[1]

7.2 Nested, Brain-Type Fenders

The question arises, what specifically is it about suicide that a cultural prohibition would forbid? Conceptually, there could be multiple targets – including the act of suicide itself, or the thought of suicide, or discussion of the thought, and perhaps other aspects of the behaviour. A comprehensive defence might be expected to deny cognitive access to the idea of suicide on all fronts.

What appears to prevail is a kind of serial fortification, with successive lines of cultural-informed defences. First, for many people, perhaps most people, talking about suicide, or even thinking about it, can be difficult. Second, even among those who can think about suicide, it is generally not believed to be an effective way to terminate pain – although a rational view might imagine it could be. Third, even among those who think suicide could effectively end their pain, suicide is generally accepted to be simply wrong. These separate elements would seem to operate partly independently, as will be discussed.

7.2.1 Suicide Is Unthinkable

First, many people seem to find suicide generally an awkward topic to talk about, a reticence found across much, perhaps most, of the world, according to anecdotal accounts (Colt, 1991). The universality of this difficulty may not be easy exhaustively to survey, given that people who do not want to talk about something presumably

[1] As a parenthetical point, this anti-suicide cultural dynamic would be expected to operate independently of whatever religious structures prevailed. Although all major world religions do censure the behaviour, an anti-suicide morality, acting as a fitness-promoting rule of thumb, would be expected to spread under its own power, with or without religious affiliations (Rottman & Kelemen, 2014).

prefer not to talk to researchers about it either (Chapple, Ziebland, & Hawton, 2015), but a widespread diffidence has been long observed and reported by therapists, to the extent that the very word may be all but unspeakable even in confidential, clinical settings (Farberow & Shneidman, 1961; Menninger, 1936).

Beyond talking about suicide, just thinking about it appears to be difficult. Joiner (2005) holds that there is something in the human mind that resists taking the idea of suicide on board, an obstacle that has actively to be overcome for suicide to become thinkable: "that most of us have trouble wrapping our minds around this concept shows the distance necessary to travel – both behaviourally and psychologically – before one has developed the capacity for seriously suicidal behavior" (Joiner, 2005, p. 92). A guide to the unthinkability of suicide may be found in people's apparent readiness to forget, or at least not to mention, their own former suicidal behaviours, a phenomenon which may explain a longitudinal anomaly found in the epidemiological record that adolescents tend to report more lifetime suicide plans and attempts than adults do (Nock et al., 2012). In one survey of students, 16 out of 40 subjects who initially acknowledged having seriously considered suicide subsequently denied it when followed up four years later (Goldney, Smith, Winefield, Tiggeman, & Winefield, 1991). Brezo et al. (2007) report a similar rate of denial or forgetfulness about suicidal thoughts in their larger-scale survey in Quebec, and find that actual suicide attempts can also be unremembered: a third of adolescents who admitted having tried to take their own lives subsequently denied it or forgot about it when interviewed again in their early 20s. Fourteen percent of those who had previously admitted to multiple suicide attempts subsequently claimed to have tried only once.[2]

7.2.2 Suicide May Be Pointless: Fear of an Afterlife

Second, even for those who can turn their minds to the idea, many, perhaps most, would have reason to doubt that suicide would successfully end their pain anyway, on the grounds of beliefs in a painful afterlife. The premise is that suicide, to the person who does it, makes sense: it is a rational choice as an effective means to escape suffering (Maris, 1982). Worries about what happens during and after death

[2] Two implied complications for suicidology may be noted. First, the outcomes of pain-type and brain-type fenders may overlap in the area of self-serving forgetting: the homeostasis of affect posited as a pain-type fender might be expected to edit or erase strongly aversive memories in general, suicidal or otherwise, with the implication that the forgetting observed by Goldney et al. (1991), Brezo et al. (2007), and others may occur more broadly than to acts and thoughts of suicide alone (Bonanno, 2009). Second, as a brain-type fender, the targeted forgetting of suicidal plans and behaviours specifically could add greatly to the difficulty of collecting consistent cross-cultural statistics in suicidology (WHO, 2012), not least because any data that relies on self-reporting may be systematically confounded by culturally informed psychological systems – the recall of one's own suicidality likely to be least reliable where the strongest taboo or other strictures against suicide prevail.

are salient to that rational decision-making, irrational though such concerns may seem. As Klinger (1977) argues, for suicide to appeal in a calculated assessment, the expected net pain/pleasure to be had from dying would need to exceed the expected net pain/pleasure to be had from staying alive, in which case the expected emotional value of any afterlife beyond, as well as the pain of the suicidal act, would enter into the equation. There would be no point in self-killing to achieve an escape from painful self-awareness (as Baumeister (1990) characterises suicide) if still worse self-awareness results.

Beliefs concerning an afterlife have complicated and ambivalent effects on suicidality. For some, the promise of comfort in the hereafter provides an encouragement to endure suffering in this life (Colucci & Martin, 2008). Others, who believe self-induced death will take them to a better place, may be more vulnerable to suicide (Phillips, Liu, & Zhang, 1999; Solomon, Greenberg, & Pyszczynski, 1997), including, it seems, some who commit acts of suicide terrorism (Sela & Shackelford, 2014). On balance, however, beliefs in an afterlife may be expected more likely to deter suicide than to encourage it, for at least two reasons. One is that, while almost all human cultures propagate the expectation of life after death, the afterlife seems generally to be an unappealing prospect whatever the cause of death: the notion of being reunited with loved ones and rewarded or compensated for hardships in this life is unusual across human cultures, according to Kluckhohn (1962), at least outside of Judeo-Christian traditions. Even within Judeo-Christian communities, the notion of a fearful afterlife may be deep-seated and prevalent. It is at least suggestive that arguably the most famous speech in Western literature, Hamlet's *To be, or not to be…* soliloquy, deals specifically with the power of this dread to block suicide as a way to escape life's travails. Shakespeare writes apparently confident that we, his audience, will not only accept Hamlet's worry about worse torment in the next world as plausibly sufficient grounds for him to choose to continue living his tormented life in this world, but that we all feel that way about our own life situations too – Hamlet notably speaks not for just himself but on behalf of "us all" (Bruster, 2007).

> But that the dread of something after death,
> The undiscovered country, from whose bourn
> No traveller returns, puzzles the will,
> And makes us rather bear those ills we have,
> Than fly to others that we know not of.
> Thus conscience does make cowards of us all
> *Hamlet*, III, i

The same dread addressed to a twentieth-century Judeo-Christian audience can be found in the hit song *Ol' Man River*, which has is its punchline, "I'm tired of living, and scared of dying...".[3]

The other reason why belief in an afterlife may prevent rather than promote suicide is that there appears to be a widespread, if not nearly universal, conviction that

[3] Or, in the form that Oscar Hammerstein II wrote the lines in 1927, "Ah'm tired of livin', An' skeered of dyin' / But ol' man river, he jes' keeps rollin' along."

suicides in particular can expect special punishments after death. Most major world religions censure suicide to the extent that, as in some eastern systems, it may affect the quality of the suicide's re-incarnation, or, in Judeo-Christian codes, the individual's prospects of going to heaven (Nelson, Hanna, Houri, & Klimes-Dougan, 2012). Anticipation of the physical pain incurred in carrying out suicide appears itself to be a significant deterrent, which requires practice, desensitisation, and determination to overcome (Joiner, 2005, 2010; Smith & Cukrowicz, 2010), a fear that may be leveraged by religious threats to amplify the pain – Islam teaches that a suicide is punished by having to re-experience over and over the pain of the suicidal act (Walsh, 2009).[4] Such concerns about pain and punishments in the hereafter might be dismissed as imaginary; but whatever an objective judgement might be on the matter, the normally prevailing cultural message would seem to present self-killing as pointless, even counterproductive, as a way for the individual to escape suffering. In the manner of a super-replicator described earlier (Gilbert, 2006), the idea of suicide's futility would expectably have propagated itself through surviving generations more successfully than would the opposite conception, that suicide works.

7.2.3 Suicide Is Wrong: The Stigma

A third category of culturally propagated obstacles may be moral. Even those who can think about suicide, even when they believe it would effectively relieve their pain, may nonetheless have to overcome the conviction that suicide is self-evidently wrong. All major religions prohibit at least some forms of suicide, particular self-killings motivated by personal and emotional troubles (Colt, 1991; Fedden, 1938; Koenig, King, & Carson, 2012). Moral objections to suicide may not necessarily or entirely arise from formal religious codes: secular beliefs about the sanctity of life (Colucci & Martin, 2008) or concerns about a suicide's effects on those left behind (Hook, 1927) may also serve as ethical constraints. Many legal systems, religious and secular, institutionalise the wrongness of suicide: most countries had laws and punishments for attempting suicide a little over a century ago, and 35 still do (WHO, 2014). Tribal punishments may be severe even now, illustrated by the destruction of suicides' homes, and the banishment of bereaved kin observed among the Baganda (Mugisha, Hjelmeland, Kinyanda, & Knizek, 2011, 2013).

This cultural proscription appears to translate into personal decision-making: moral and religious objections recur as a powerful protective factor and are often cited as reasons why people do not take their own lives (Colucci & Martin, 2008; Dervic et al., 2011; Durkheim, 1897/1952; Gearing & Lizardi, 2009; Koenig et al.,

[4] It might be added that even those without religious convictions may find the uncertainty of what happens after death a deterrent (Krause et al., 2002). The fear of death, which existential philosophers hold to be an all-pervasive feature of the human condition, may bring its own problems (Camus, 1955; Pyszczynski, Greenberg, & Solomon, 1997; Yalom, 1980), but it could be expected to have a protective anti-suicidal effect that more than outweighs its downsides.

2012; Linehan, Goodstein, Nielsen, & Chiles, 1983; Lizardi et al., 2008; Lizardi & Gearing, 2010; Malone et al., 2000; Nelson et al., 2012; Nock et al., 2012; Stack, 1983, 1992; Stack & Kposowa, 2011). The moral closing off of a suicidal escape may be understood to produce a snared sense of being "condemned to live" (Farberow, Kang, & Bullman, 1990)[5] or "trapped into living" (Swinton, 2001) – a feeling of being obliged to soldier on in spite of one's misery. Powerful moral objections, then, may be understood to operate on the "brain" side of a pain-and-brain model of suicide, restricting access to the means of suicide even among those who might have the pain-driven motivation to take their own lives.

7.3 The Suicide Taboo as a Fender System

A universal or near universal taboo against suicide may work to sustain culturally transmitted obstacles to suicide – perhaps its unthinkability in particular. A dark fear of suicide recurs as a powerful and ancient cultural feature. Even in the modern west, suicide evokes the kind of visceral dread that might be expected of a transmittable mortal disease. Those bereaved by suicide can testify to this pariah-like state – they use terms such as "fear," "some kind of infection," and "contamination" to describe the social detachment they experience (Chapple et al., 2015). Today's anti-suicide superstitions, institutional strictures, and stigma follow a direct line of descent, Fedden (1938) argues, via the degradation of suicide corpses and other special punishments that were once commonplace across medieval Europe, through to the rites and preoccupations of pre-literate tribes. In England as recently as the 1870s, a fictional burial in Thomas Hardy's *Tess of the d'Urbervilles* takes place in what Hardy describes as "that shabby corner of God's allotment where He lets the nettles grow, and where all unbaptized infants, notorious drunkards, suicides, and others of the conjecturally damned are laid."

Surveying this patterned, primal horror of suicide, Alvarez (1971, p. 66) asks a reasonable question that may be central to this enquiry: "why should a gesture so essentially private inspire such primitive terror and superstition?" To offer a plausible answer, suicide may not in fact be just a private matter; it may pose a severe, existential, communal threat in the precedent of acceptability that it sets for others. If this is true, then fear, condemnation, and stigma, manifest and propagated by a taboo, may serve a functional, protective social purpose. The taboo may regarded as one of many basic, biologically rooted, essentially universal moral axioms, alongside a prohibition of incest and other ethical commonplaces, which, Kluckhohn (1962) argues, characterise healthy societies. It may be telling that the stigma on suicide is not easily malleable – it generally endures despite long-standing policy efforts to relieve it (Sudak, Maxim, & Carpenter, 2008; WHO, 2014).

[5] The same phrase, interestingly, is also used by Laing (1960) to describe the anti-suicide effect of psychosis, the arguably delusional structures of religiosity and psychopathology on this basis presenting an equivalent defence.

That a suicide taboo is only virtually, not absolutely, universal – the topic seems to have been discussed in certain cultures and historical eras with ease (Fedden, 1938) – may indicate not that the taboo is dispensable but rather that, as Kluckhohn (1962) posits, some societies are sick. To speculate, based on the consistency of anecdotal reports from suicide hotspots, the outcome for communities that are sickened in the sense that the suicide taboo has broken down may be a catastrophic and endemic escalation in suicides. Hezel (1976), investigating a decades-long epidemic of self-killings among youth in Micronesia, observes that suicide in places has become "an ordinary topic of conversation, an accepted fact of life, discussed openly and dispassionately as an option in trying circumstances." Rubinstein (2002) likens the outbreak to a contagion; as young Micronesians gain familiarity with suicide, it becomes increasingly acceptable and even expected. Frequent suicides among the Aguaruna tribe in Peru have been linked with a similar familiarity: self-killing has become "something that people have just learned to do" (Brown, 1986). In the Philippines, Macdonald (2007) reports that suicide has "become an accepted model of behavior" among people of the Kulbi-Kenipaqan basins, with constant references to self-killing featuring in ordinary conversation. Hoskin, Friedman, and Cawte (1969) finds that variations in suicide rates in Kandrian, New Guinea, are linked with the strength of the taboo, which in some blackspots of suicidality has not only broken down but actively reversed. The phenomenon of copycat suicides, clusters of imitative incidents, has been documented at least since Goethe's 1774 novel *The Sorrows of Young Man Werther*, in which the hero takes his own life, was banned by concerned authorities. Since pioneering work in the 1970s by David Phillips, numerous statistical studies have detailed a contagion effect, by which suicide rates vary with the intensity, extent, and content of exposure, in both close and dispersed communities (Andriessen, Rahman, Draper, Dudley, & Mitchell, 2017; Gould, Greenberg, Velting, & Shaffer, 2003; Gould, Wallenstein, & Davidson, 1989; Kral, 1994; Marsden, 1998; Phillips, 1974; Stack, 2003a, 2003b). Exposure to the idea of suicide can, in itself, increase risk: it is at least conceivable on this basis that the heritability of suicide, that suicide runs in families, occurs in part because the suicides of others "makes the unthinkable thinkable" (A. Solomon, 2014).[6] Young adults appear to be particularly at risk from the culturally transmitted idea that suicide is an acceptable solution to distressing life problems (Hezel, Rubinstein, & White, 1985). Adolescence, being a life stage when the developmental biological process of apprentice-type learning is in full flow (Bogin, 2010), an age when cultural suggestions are most readily absorbed, may be a time of particular susceptibility to suicide ideas (Maris, 1991). It may be a time of life when the intellectual capacity for suicide arrives, but the culturally informed psychological defences required to block suicide are incomplete and/or vulnerable to being overwhelmed by the opposing message that suicide is countenanceable.

[6] Although see Schulsinger, Kety, Rosenthal, and Wender (1979), whose Danish adoption studies report suicidality to be spread in families by genetic rather than cultural transmission. The methodological credibility, indeed the integrity, of the research programme from which Schulsinger et al.'s (1979) paper arose has been challenged (e.g., Joseph, 2001).

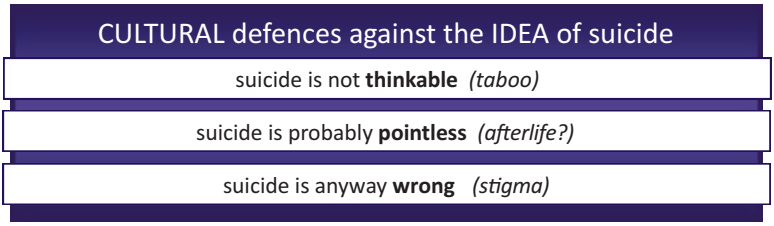
CULTURAL defences against the IDEA of suicide
suicide is not **thinkable** *(taboo)*
suicide is probably **pointless** *(afterlife?)*
suicide is anyway **wrong** *(stigma)*

Fig. 7.1 Brain-type fenders as successive cultural barriers to suicide

The implication for our purposes is that if a conditioned fear of suicide would be expectably adaptive for both individual fitness and for the group's success, then the suicide taboo may conceived as an adaptive system, a means by which a protective dread may be propagated and sustained (Rachman, 1977). As may be the case with ethical rules generally (Lachmann, 2014), the suicide taboo may instantiate in most human societies by a process of cultural natural selection. This study proposes that the taboo may have evolved and operates as a brain-type fender, a line of defence that blocks the idea of intentional self-killing. Given the gravity of the fitness threat, it might be surprising if such a protective taboo were not found (Humphrey, 2018).

7.4 Summary and Conclusions

Brain-type fenders, it is argued, would sap the individual's cognitive capability to organise suicide but in ways designed to cause minimal interference with general intellectual faculties: our general intelligence is worth protecting – it may be an adaptive feature that was so powerfully important to reproductive fitness in human evolution that the incidental cost even of suicidality was tolerable. To minimise collateral damage, brain-type fenders would expectably seek to disable the narrow idea of suicide specifically – to make wilful self-killing not thinkable; even if it were thinkable, probably futile as a way to escape pain; and, even if it were not futile, anyway self-evidently wrong. Figure 7.1 envisages these cognitive obstructions as layers, successive barriers that form an integrated cultural system of evolved defences.

By a process of natural selection operating at multiple levels, among both individuals and groups, cultural inputs along these lines could, and presumably would, emerge to this end, transmitting themselves across generations. They may be manifest in the expectation of punishment in the afterlife, moral prohibitions, and a fear-perpetuating taboo. Encultured obstacles to suicide may be almost, but not quite, universal: where the taboo breaks down, as it can do, epidemics of suicidality can occur. It may be concluded that a societal stigma and strictures against suicide, while they may feel arbitrary and cruel to the bereaved, could serve on balance a life-saving purpose, particularly among adolescents. Once lost, a taboo on suicide may be difficult to restore, a point that will be revisited in the final chapter.

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Chapter 8
Summary, Conclusions, Implications

> *Life is a gift given to us without our opinion being taken into account – but our active support is necessary if this life is to be conducted to its term.* – Baechler (1975/1979, p. 450)

This book set out to try to resolve the evolutionary puzzle of suicide — intentional, deliberate self-killing. It sought to arrive at a satisfactory theory of how natural selection, which axiomatically requires organisms to survive and reproduce, could lead to the flourishing of an animal with the potential for so self-destructive a behaviour.

The evidential path – evolutionary theory, epidemiology, and other information inputs – has led to the proposal that suicidality probably arose in the human species as a noxious by-product of two adaptations combined: pain, an animalian biological signal that demands action to escape it; and the emergence of the human intellect, which offers intentional self-killing as a means to obey that demand for escape. Suicidality, on this basis, may be viewed as one of the design complications arising from the hierarchical, piecemeal way the human brain evolved, natural selection incrementally tinkering rather than elegantly engineering (Coyne, 2009; Jacob, 1977): an evolutionarily new thinking brain, grafted onto an ancient emoting brain, brings with it the problem of coordinating the assemblies (MacLean, 1949; Panksepp & Watt, 2011). Such coordination challenges have dominated this inquiry. Most of this book has been devoted to examining secondary adaptations which are posited to keep the fitness impact of the suicide by-product within sustainable bounds – layers of kludges and compromises which usually safeguard the human organism from suicide, but at the cost of tactically attenuating aspects of its emotional ("pain") and cognitive ("brain") functioning.

Figure 8.1, a concluding summary graphic, suggests a framework by which evolved systems may be understood to form successive, but only imperfectly impermeable, lines of anti-suicide defences. The account will be summarised and assessed in more detail below and followed by a discussion of some ramifications for suicide prevention, the treatment of psychopathology, and the broader study of the evolution of suicide.

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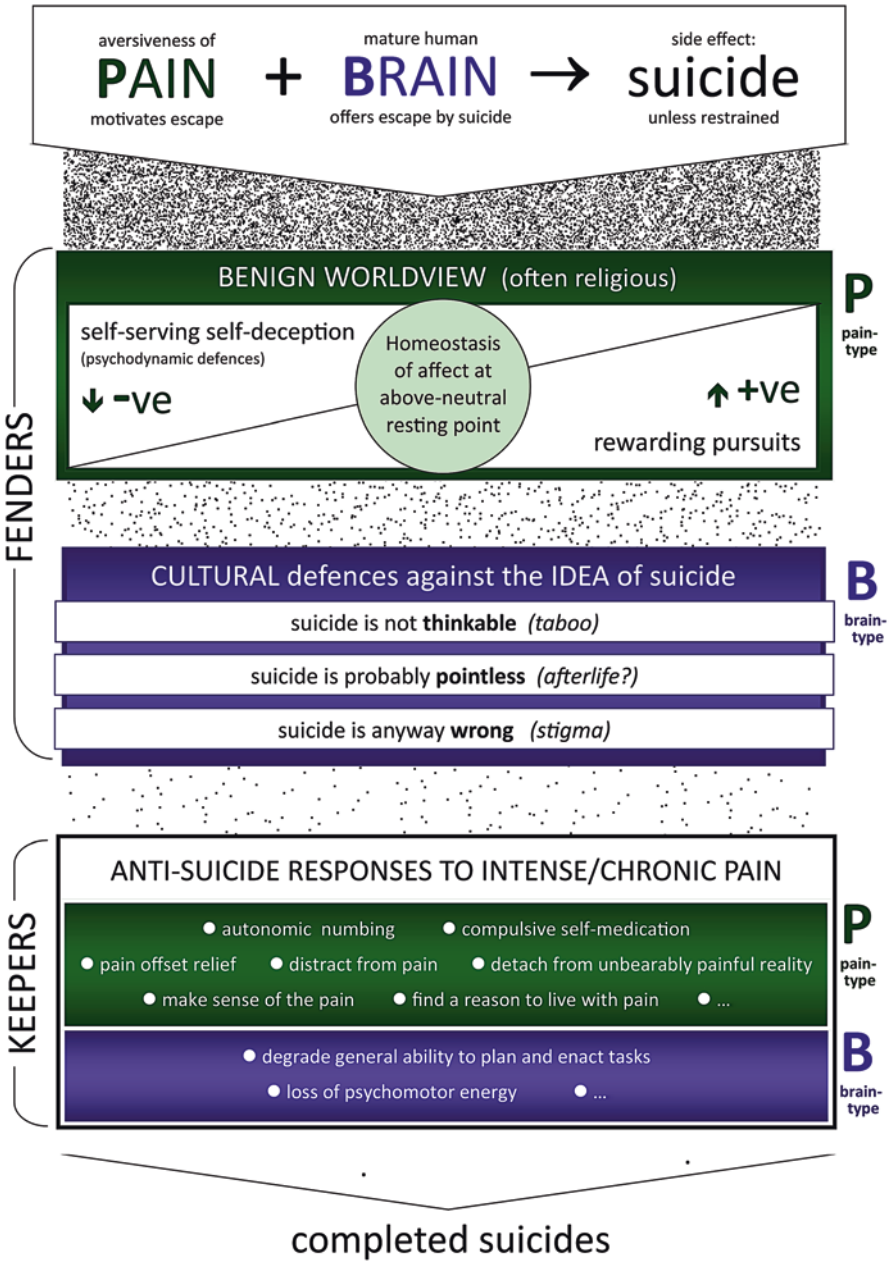

Fig. 8.1 The evolution of suicide: a concluding framework of successive lines of "pain and brain" defences

8.1 Summary: An Evolutionary Model of Suicide

8.1.1 "Pain and Brain" Are Necessary Conditions for Suicide

Chapter 2's review of the three possible evolutionary explanations of suicide deduced that suicide was unlikely to have come about as an adaptation: the extreme fitness costs and doubtful benefits of being dead suggest that suicide itself was probably not favoured by natural selection on account of reproductive advantages it may have given to the offspring and other close kin of those who killed themselves. It would probably not have spread through the human population by chance, as genetic noise, either. The most likely account seems to be that suicide emerged as a maladaptive side effect of other traits that were adaptive: specifically, a combination of two primary adaptations whose fitness benefits were so potent that they were worth the cost even of suicidality – pain, and the mature human brain. An ancient warning system, emotional pain is probably designed to force the animal to attend to threats to its vital social relationships and/or meaning systems. Like physical pain, and perhaps more so, emotional pain is intrinsically aversive: pain is biologically designed to compel an escape action. The intellect of the mature human brain – consciousness, foresight, logical thinking, high-level intentionality, and other general intellectual faculties – may account for mankind's rapid colonisation of much of the planet, but it also opens up the unfortunate option for cognitively mature humans to escape pain by self-killing.

In other words, suicide probably is not, and never would have been, adaptive in the evolutionary sense – that is, in the sense that the behaviour may itself have been selected because of reproductive fitness gains it supposedly conferred as it passed through successive generations. Suicide can be well understood as adaptive in the psychological sense of being adjustive, inasmuch as it offers human beings a proximate solution to the organism's urge to end aversive affect (Shneidman, 1985).

8.1.2 "Pain and Brain" Are Sufficient Conditions, Unless Restraints Co-evolved

These "pain and brain" elements are arguably not only necessary conditions for suicide but, in the absence of restraints, sufficient: pain provides the motivation; the mature human brain provides the means. Any animal aware that it could end its pain by taking a certain course of action would reasonably be expected to do so, unless some obstacle or intervention forced a change of course. If this is correct, it follows that, from the point in the evolution of human cognition at which our ancestors' intellect surpassed a threshold at which intentional self-killing became a conceivable and enactable option, suicide would have presented a grave, recurring fitness threat. Natural selection would expectably have responded rapidly to that threat, strongly favouring reactive countermeasures designed to avert suicide among

humans at imminent risk. A defensive line of reactive, anti-suicide, evolved psychological mechanisms (*keepers*) would expectably have emerged to forestall many, but evidently not all, suicides. These defences would have evolved only to the point at which the marginal fitness cost incurred by further restraints balanced the marginal gain won from further reducing the actuarial risk. Because any outcome short of death may be preferable in fitness terms to suicide, these emergency responses could be drastic. They might sometimes themselves become pathological.

8.1.3 A Design Specification for Keepers: Reactive, Last-Line, Anti-suicide-Evolved Psychological Mechanisms

Following a standard method of forward engineering drawn from evolutionary biology and evolutionary psychology (Tooby & Cosmides, 1992; Williams, 1992), some likely *a priori* design features and expected manifestations of a suite of keepers were inferred. The objective of these systems would be to forestall suicide among those in suicidogenic pain. It is fair, then, to anticipate that emotional pain, by some algorithm that combines the longevity and intensity of the affective experience, would be recruited as the primary activating input. The absence or easing of this pain input would, by the same token, act as the deactivating signal, leading to a spontaneous, if cautious, standing down of the keeper response once the triggering pain was relieved. Keepers would fulfil the design objective by attenuating one, other, or both, of the twin "pain and brain" drivers of suicidal behaviour: they would seek to weaken the pain-induced motivation for suicide, or inhibit the organism's access to the cognitive means to organise suicide, or most likely a combination of the two. There being multiple means to achieve the same ends, there is the potential for outwardly disparate defences to be functionally equivalent – mobilised by the same input and designed to achieve the same objective. The severe fitness risks of failure (potentially, suicide) would call for a high level of system robustness, on which basis multiple forms of functionally equivalent keepers would probably operate in the same high-risk individual (Kitano, 2002; Wagner, 2005). Keepers might be expected to instantiate in different blends and sequences as required to accommodate individual differences and other contingencies. Given, again, the extreme gravity of suicide as a fitness threat, keepers' behavioural and cognitive countermeasures would be strongly compulsive, resisting conscious interference or even awareness of their operation (Cosmides & Tooby, 1994; Williams, 1966). They would tend to be accompanied by protracted anxiousness, the prototypical mammalian response to a danger that, while grave, is not locatable and from which flight is therefore not possible (Neuberg, Kenrick, & Schaller, 2011; Woody & Szechtman, 2011). Keepers would not be expected to have evolved in non-human animals, although rudimentary evolutionary homologues may be found, nor would they activate in humans younger than the typical age at which suicide becomes a fitness threat – not before, that is, the early teenage years. Keepers' activation would associate strongly with suicide ideation, but only weakly, if at all, with ideators'

suicidal plans or attempts: these thoughts-into-action progressions, situations where the suicidal organism has overcome its autonomic restraints, would constitute a filtrate that anti-suicide defences were by definition unable to predict or block. Most suicides would, however, be accompanied by keepers that had properly, but unsuccessfully, mobilised in response to a detected threat.

8.1.4 Common Mental Disorders (CMDs) Correspond to the Specification of Keepers

This hypothetical design specification of keepers would appear to find a real-life match on multiple counts in some symptoms of common mental disorders (CMDs) – major depression, alcoholism and other addictions, psychotic delusions, non-suicidal self-harm, obsessive-compulsive disorders, and perhaps other psychiatric syndromes. Among other commonalities observable across CMD diagnoses, diverse psychiatric syndromes are found usually to be preceded by emotionally painful life events, mirrored by the relief of painful circumstances that precedes remissions (Brown, 2009; Harris, 2000). CMDs' first onsets are usually no earlier than the teen years (Kessler et al., 2007).

Some symptoms of depression, addiction, self-harm, obsessive disorders, and psychotic delusions are indeed posited by some clinicians to address the pain component of suicide's causation, exploiting diverse autonomic opportunities to contain acute psychache (Hendin, 1975; Himmelhoch, 1988; Hundert, 1992; Menninger, 1938). These pain-type mechanisms may include a general deadening of affect, self-administered analgesia, distraction, exploiting pain-inhibits-pain neural circuits, and the selection of delusional rationales to explain away the pain and/or to provide reasons to endure it. Other symptoms of CMDs may deal with the cognitive component of suicidality and could be understood as emergency interventions designed to restrict the individual's access to the means of suicide: these brain-type keepers would attenuate the intellectual and psychomotor capacity to plan, organise, and carry out a suicidal act, as may instantiate in the indecisiveness and lethargy characteristic of depression.

As further points of consistency with the *a priori* design specification of keepers, CMDs are typically observed to co-occur in clusters in the same individual, often alongside anxiousness, a patterned comorbidity that points to a shared aetiology (Caspi et al., 2014; Goldberg & Goodyer, 2005; Stochl et al., 2015). CMDs strongly correlate with suicidal thoughts, but only weakly with the progression of those thoughts into suicide plans and attempts (Klonsky & May, 2014; Nock et al., 2015). Many or most suicides are associated with a diagnosable mental disorder (Cavanagh, Carson, Sharpe, & Lawrie, 2003). Although non-human animals can suffer psychopathological problems, there is no evidence of any other species experiencing the diversity and prevalence of psychiatric syndromes characteristic of humans (McGonigle & Ruggeri, 2014; Ramsden, 2015).

Taken as a whole, these multiple correspondences between CMDs and an *a priori* specification of keepers suggest that CMD symptoms can be plausibly understood as a last-ditch line of defences against suicide. It may be simpler to accept this hypothesis than not, as the alternative would call for another array of psychological mechanisms to be found, other than CMDs, which meets the keeper specification.

8.1.5 A First Line of Pain-Type Anti-suicide Defences: Pain-Type Fenders

The activation of keepers, if that is what CMDs are, while preferable in fitness terms to death by suicide, incur heavy fitness costs nonetheless. They entail a potentially drastic interference of normal affective and cognitive operations, which is likely materially to impair the individual's survival and reproductive prospects. CMDs are indeed associated with much reduced life expectancies (Chesney, Goodwin, & Fazel, 2014) and fertility (Keller & Miller, 2006) compared to those without CMDs.

A fitness threat so severe would expectably lead natural selection to favour preemptive countermeasures, designed to prevent pain escalating in the human organism to the point at which keeper emergency defences must intervene. A system of frontline anti-suicide evolved psychological defences, pain-type *fenders*, would be expected to exist, designed to balance the conflicting needs of preventing the onset of suicidogenic psychache while allowing the organism still to feel enough pain successfully to navigate its environment. Some likely features of these fenders can be inferred *a priori*. Unlike keepers, fenders would operate continuously, rather than activate specifically in response to extreme or chronic pain. So that the individual may evade at least some of the painful implications of informational inputs from the world, pain-type fenders would probably involve a systematic self-serving self-deception (Paulhus & Buckels, 2012; Sackeim, 1988). They would regulate affect around a homeostatic resting point prudently higher than neutral on the pleasure-pain continuum (Cabanac, 2010; Young, 1959). The system would seek to keep the individual in a generally pleasurable state, willing to endure the experiences of painful reality, and happier than an objective appraisal of the real biological world would justify (Diener & Diener, 1996; Heintzelman & King, 2014; Sharot, 2011).

If this design expectation is correct, its implications could be far reaching. To avoid psychopathology, ultimately to survive at all, humans may need to devote much time to pursuits that generate a flow of emotionally rewarding experiences: the affective payoff of these behaviours would need to be sufficient to motivate the individual to tolerate pain, and they would not arise directly from the normal biological needs of survival and reproduction. Further, in order to sustain an unrealistically positive stance despite recurring errors of prediction that would follow, humans would be required selectively not to learn. This need tactically to avoid learning suggests that an unrealistically benign model of self-in-the-world would need to be held in the mind as a distorting perceptual lens and that this paradigm would have to be protected from the potentially updating effect of continued factual disproofs (Epstein, 1973; Kuhn, 1977;

Parkes & Prigerson, 2010). On the grounds that a benign worldview is probably easier to defend collectively than individually (Festinger, Riecken, & Schachter, 1956), religiosity could be understandable as a biologically adaptive form of pain-type fender. Our perception and inhabitation of a moral universe, and the "God" idea, could be manifest in the human urge to do good even in situations where there could be no possible reciprocal payback for the actor or even a competitive gain for the actor's group.

8.1.6 Resisting the Idea of Suicide: Brain-Type Fenders

Independently, a set of brain-type fenders would seek to keep the idea of suicide unavailable to conscious cognition, by making the option of suicide unattractive and preferably not even conceivable. A moral disgust of suicide would expectably transmit itself through the relative success of those cultures that acted on such beliefs, along with fearful beliefs about an afterlife. A suicide taboo, by this model, could be viewed as an adaptive, self-propagating anti-suicide defence system. The objective of brain-type fenders would be to deny access to the intellectual means of suicide, including from those whose suffering would reasonably motivate self-killing.

8.1.7 A Framework of Evolved Defences Against Suicide

Collectively, the suggested array of evolved defences against suicide may be summarised as successive lines of protective systems (Fig. 8.1, p. 252) or in the form of a 2 × 2 matrix (Fig. 8.2, below). To repeat a point already made, the reality may not

	Pain-type (weaken motivation for suicide)	**Brain-type** (restrict mental access to lethal means)
Fenders (first-line defences)	• Homeostasis of affect at above-neutral resting point. • Self-serving self-deception (SSSD) • Biologically irrelevant, pleasurable pursuits. • Benign worldviews (including religiosity, God).	• Culturally-transmitted attack on idea of suicide makes it… • unthinkable (taboo, disgust)… • pointless (painful after-life), and… • wrong (stigma, moral objections).
Keepers (last-line defences – CMD symptoms)	• Autonomic numbing. • Compulsive self-medication. • Pain offset relief. • Distraction. • Detachment from reality. • Rationalising of pain. • Selecting reasons to live with pain. …	• Degraded cognitive ability to plan and enact tasks. • Loss of psychomotor energy. …

Fig. 8.2 Summary of posited evolved anti-suicide defences

be so tidy: some mechanisms may straddle cells, for example, others may differ in degree more than kind, and several may be not actually be distinct entities but are, rather, reifications of what may be an indivisible underlying system.

The evolution of suicide, according to this model, induced the emergence of complex, integrated systems of counter-adaptations, the actions of which may permeate much of human experience and behaviour. As a whole, they may be understood to provide humans with the means voluntarily to live with pain – to tolerate a biological signal that is intrinsically designed not to be tolerated.

8.2 How Well Does This Explanation Meet the Book's Objectives?

The Introduction (1.5 above) listed five criteria which Kuhn (1977) takes to cover the consensus view of how the quality of scientific theories are assessed:

(a) Accuracy – the deducible outcomes of a good theory should align with extant empirical findings.
(b) Consistency – a good theory should both be internally coherent and integrate with other domains' accepted theoretical frameworks;
(c) Breadth of scope – the consequences deducible from a good theory should reach beyond the phenomena the theory was formulated to explain.
(d) Simplicity – a good theory should illuminate patterns in what would otherwise appear as disordered relationships and phenomena.
(e) Fruitfulness – a good theory should open the door to novel discoveries.

The question now arises, to what degree does the conclusion of this project – a "pain and brain" evolutionary model of suicide – meet Kuhn's criteria for success?

8.2.1 Accuracy

While there is certainly scope for intuitive objections (e.g., in the perhaps startling notion that most mental disorders may actually be evolved defences against suicide), and while it is hard to prove a negative, a survey of standard texts suggests that none of the deducible consequences of the proposed account would invite contention on the grounds of inconsistency with the empirical knowledge bases of suicidology, psychopathology, psychology, or general biology.

This lack of counter-evidence is, importantly, not a result of the theory's unfalsifiability (Popper, 1935/2002). There would be many potential opportunities for disproving the theory, such as by the discovery of a single case of intentional self-killing carried out by a non-human animal other than in the course of other, fitness-promoting,

behaviours; or any sizable human culture where suicide did not occur; or anywhere where significant suicides were found among pre-pubescent children; or any sizeable population where psychopathological syndromes such as depression and addictions were not associated with an increased risk of suicide and comorbidity; or where suicides routinely occur in individuals without concommitent emotional pain; or any sizeable culture where religiosity, meaning, and purpose in life are not protective against suicidality; or any biomarker that usefully predicts where, when, and among whom suicide will occur; or the discovery of a single alcoholic, depressive, or schizophrenic non-human; and so on.

8.2.2 Consistency

The proposed model would appear to be integrated within itself – in that, for example, the posited "pain and brain" evolutionary causes of suicide map onto posited "pain and brain" evolved anti-suicide defences. The model also offers external consistency with accepted theoretical frameworks of related domains, notably, modern evolutionary biology's tenets of inclusive fitness (Hamilton, 1964a, 1964b) and multilevel selection (Wilson & Wilson, 2007). The model tallies with the major correlational models of suicidology, through the operative role of suicidogenic pain (Durkheim, 1897/1952; Shneidman, 1993), and with modern "ideation-to-action" theories, through the explanation of CMDs' link with suicidal thoughts rather than with planning and attempts (Klonsky & May, 2015; O'Connor, 2011; Van Orden et al., 2010). The proposal would appear to offer potentially a point of integration with a number of established fields of psychology, including psychodynamic theory (Jacobs, 2012), positive psychology (King & Hicks, 2012), error management (Galperin & Haselton, 2012), evolutionary psychology (Buss, 2005), as well as links to at least some of the major tenets of neuroscience (MacLean, 1990; Panksepp, 1998), behavioural genetics (Keller & Miller, 2006), and psychiatry (APA, 2013; Goldberg & Goodyer, 2005).

8.2.3 Breadth of Scope

The consequences deducible from the proposal make connections with many subdomains of suicidology that may not, at first sight, have evolutionary relevance. These include the likely existence of apparently irreducible base rates of suicidality in human populations (Andrés & Halicioglu, 2011); the pattern of correlations between mental disorder and suicide ideation and action (Nock et al., 2015); the apparent non-existence of suicide in non-human animals and virtual non-existence of suicide among young children (Baechler, 1975/1979); the near universality of

religious strictures against suicide (Gearing & Lizardi, 2009); the inability usefully to predict individuals' suicide risk (Chang et al., 2016); and the universal or near-universal prevalence of a suicide stigma and taboo (Fedden, 1938).

Other consequences reach well beyond the evolution of suicide that the theory sought to explain. These extensions include the comorbidity and lack of specificity in the risk factors and treatments of CMDs (Caspi et al., 2014), the phenomenon of depressive realism (Alloy & Abramson, 1979), the patterned age of first onset of common mental disorders (Kessler et al., 2007), the power of life events to provoke CMD onsets and remissions (Harris, 2000), the net positive effects of spirituality and religion on mental health (Koenig, King, & Carson, 2012), the ubiquity of religion (Schloss & Murray, 2009), the limitations of animal models of psychopathology (McGonigle & Ruggeri, 2014), and the discovery of optimism bias and self-serving self-deception as modal human conditions (Chance & Norton, 2015; Sharot, 2011). It could rightly be argued that all these phenomena are already known to science: considerable novelty, nonetheless, lies in the provision of a theoretical framework that not only may account for them individually, but may potentially explain them as a collective unity, with a shared evolutionary aetiology.

8.2.4 Simplicity

The proposals may, from a conceptually straightforward "pain and brain" model of suicide's evolutionary origins, offer a parsimonious elucidation of disordered relationships and phenomena in a number of domains. For example, if the theory is correct, it suggests that a resolution of the evolutionary paradox of suicide may help to resolve other, apparently unconnected, evolutionary puzzles, including the prevalence of self-serving self-deception (Krebs & Denton, 1997; Trivers, 2010); religious and spiritual belief (Schloss & Murray, 2009; Wilson, 2010); true, charitable altruism, as opposed to reciprocal altruism (Trivers, 1971); heritable mental disorders (Nesse & Williams, 1995); and the resources humans invest into apparently non-adaptive pursuits (Pinker, 1997). The systematic irrationality observed in all of these phenomena may ultimately be traceable, at least in part, to a biological imperative to attenuate and manage either the emotional pain that can motivate humans to take their own lives or the human intellect's capacity to do so.

8.2.5 Fruitfulness

Kuhn argues that a good theory should open up opportunities for novel research findings, uncovering relationships and phenomena that were previously unseen. To what extent this criterion has been met will remain to be seen, but some general directions for future research are suggested in the following section.

8.3 Implications for Clinical Interventions and Suicide Prevention

If the thrust of this investigation is correct, then specific implications arise for clinical and public health policy in the area of suicide prevention, offering theoretical support to certain views that many in the field have already reached by observational experience. These will be discussed under the headings of the three broad approaches by which suicide may be prevented: easing the mental distress that motivates suicide, restricting access to the physical means of suicide, and reinforcing ethical and moral objections (Pokorny, 1992).

In particular, this study could provide theoretical support for what many working in the field of suicide have come to suspect in view of the failure of decades of research to identify clinically usefully predictive factors by which suicide risk may be assessed (Chang et al., 2016; Carter et al., 2017; Murray & Devitt, 2017): it may be time for a shift of paradigm (Barber & Miller, 2014; Hawgood & De Leo, 2016; Hjelmeland, 2013). By this book's thesis, in order to identify an actionable predictor of suicide, at least from the information available to the organism itself, researchers would be required to achieve what thousands of generations of natural selection have failed to do. It might not be an impossible task, but success would expectably be difficult and costly. The point has been made already that the unpredictability of individual suicide incidents may reflect not a failure on the part of researchers, but the success of natural selection in already having identified any and all useful markers of suicide risk, and in already having used those markers to forestall those suicides that can be so forestalled (4.2.2). This inference need not be taken as a counsel of despair. Rather, it suggests that the best prospects for reducing suicide may lie elsewhere, particularly in restricting access to physical and cognitive means of self-killing.

8.3.1 An Evolution-Informed Focus on the Pain Motivation for Suicide

If suicidality is to be combatted, the posited unitary motivator of suicide – chronic, intense, emotional pain, or the emotional aversiveness of pain – could point to a central need to deal with pain's diverse and individual psychosocial origins. Pain warrants attention with or without suicidality, almost by definition – it is designed to demand focus (Eccleston & Crombez, 1999). From an evolutionary perspective, pain can be presumed to contain biologically important information concerning the presence of a fitness threat, a specific hazard that across human history correlated with reduced survival and reproductive success (3.1.2 above). Until the threat is addressed, the pain can be relied upon to persist. Hence, chronic pain may be understood as a friendly, if unwelcome, alert to an ongoing need (Brand & Yancey, 1993; Wall, 1979). At least five implications arise.

8.3.1.1 Lifting the Stigma: CMDs as Healthy, Evolved Responses

First, it ought not to be hard to identify the people most in need of help: if this analysis is right, nature provides a conspicuous biomarker of emotional pain, in the onset CMDs; CMDs may be poor predictors of suicidality, but reliable indexes of intense and chronic suffering. In an ideal world, people experiencing CMD symptoms might accept their conditions in such a light, as states that signal a malaise for which care may be required, and come forward to seek help.

That such an attitude towards CMDs may not currently prevail can be traced to circular trail of fear and ignorance: arguably the main obstacle to the delivery of healthcare in the sector is the stigma surrounding mental disorder (US-DHHS, 1999). The stigma can in turn be attributed at least in part to a fear of the unknown. In the absence of clear explanations as to why CMDs arise and what to do about them, there remains no consensus as to the causation of most mental disorders, even among the professionals charged with treating them (APA, 2013; Carlat, 2010b). While this absence of accepted theoretical foundations persists, progress in mental health may expectably be slow (Davies, 2013; Faucher, 2016; Nesse & Jackson, 2011). Ignorance may breed neglect: as Jaspers (1923/1963) points out from within psychiatry, we do not value what cannot be understood. If, perhaps along the lines of the theoretical framework suggested by this book, a unifying explanation could be established for the experience of CMDs, one that places CMD symptoms alongside coughs, vomiting, fever, and other ways in which the healthy human organism is understood intuitively to defend itself from biological threats, a path might be open to assuage the fear and to de-sting the stigma. CMDs might attract less of the language of deficiency, disorder, and failure (Garson, 2014) and join their physiological counterparts as normal, ordered, and treatable conditions (Cosmides & Tooby, 1999).

8.3.1.2 The Self-Healing Mind and the Value of Spiritual/Religious Resources

With regard to the treatment of those in need of help, this investigation gives theoretical backing to the longstanding observation that most cases of CMDs, analogous to physiological immune responses, remit spontaneously, given time and amenable conditions (Epstein, 1989; Goldberg & Goodyer, 2005; Menninger, 1963; Rogers, 1957), with or without medical interventions. The style of intervention most likely to accelerate recovery, as physicians accept is routinely the case with physiological medicine, is to leverage, mimic, or otherwise seek to cooperate with the organism's innate capacities to heal (Atala, Irvine, Moses, & Shaunak, 2010; Nguyen, Orgill, & Murphy, 2009). The nature of autonomic restorative processes as they may apply to psychiatric conditions is poorly understood and would seem to warrant much closer investigation. Consistent with the model proposed here, they might be expected to involve, crucially, the homeostatic processing of emotional pain and the managed cognitive accommodation of painful realities of life (Bonanno, 2009; Gross, 2014; Kent, Davis, & Reich, 2014).

The restorative potential of spiritual and religious resources may offer a particularly promising line of research to this end. Chapter 6 argued that religiosity and spiritual beliefs may play a central role in evolved defences against suicide, permitting necessarily benign worldviews to be defended communally from factual attack (6.3.2 above). While not fail-safe, and while no doubt introducing new problems of their own, religious observance and spiritual beliefs have long been observed generally to promote good mental health and to provide resilience against psychopathology (Bonelli & Koenig, 2013; Greenfield, Vaillant, & Marks, 2009; Jung, 1933/2010; Koenig et al., 2012; Pearce, Rivinoja, & Koenig, 2008; Sims & Cook, 2009; Stevens & Price, 2000; Swinton, 2001; Vaillant, 2013b; Vaillant, Templeton, Ardelt, & Meyer, 2008; Watts, 2007). However, in the face of a longstanding and widespread scepticism in psychiatry, traceable to Freud's (1907/1959, pp. 126-127) dismissal of religion as a "universal obsessional neurosis," spirituality and religion as therapeutic opportunities have struggled to win clinical credibility. The only domain of mainstream psychiatric medicine where such methods have so far found acceptance is alcoholism and addiction, led by the empirically evidenced success of Alcoholics Anonymous and other "twelve-step fellowships" (Alcoholics Anonymous, 2001; Connors, Walitzer, & Tonigan, 2008; Public Health England, 2013; Timko & DeBenedetti, 2007; Vaillant, 2013a). The twelve-step recovery model has roots in a Jungian precursor to modern evolutionary psychology, briefly discussed in Chap. 6. Jung argues that humans are born pre-equipped with certain archetypal conceptual blueprints, including a "Spirit" archetype (sometimes called "God"), that require appropriate ontogenetic inputs – experiences in the course of development – for their healthy actualisation (Jung, 1933/2010, 1961; Schoen, 2009; Stevens, 2002; Stevens & Price, 2000). Jung's framework is akin to the ethological principle of imprinting, explored seminally by Konrad Lorenz in his work with birds in the 1930s. Lorenz argues that many instinctive behaviours are designed to be triggered by innately pre-specified environmental stimuli: if deprived of the right stimulus, an animal can eventually be triggered into a particular behaviour anyway by some other stimulus that meets basic properties of the innately specified one (Lorenz, 1949/2002). Among humans, in the absence of a coherent moral universe to inhabit, individuals may be compelled to turn to alcohol and other pain-management solutions instead: the simple treatment for alcoholism, to paraphrase Jung's "*spiritus contra spiritum*" wordplay, is to substitute one form of spirits for the other (Jung, 1961). It may surprise many to find, in Alcoholics Anonymous and other twelve-step programmes, that an empirically supported form of spiritual therapy is grounded in a longstanding evolutionary theory. Jung himself was unaware of his essential role in AA's formation until late in life (Bluhm, 2006). By Jung's scheme, a range of psychopathologies, not just addictions, may be expected to lift spontaneously following the kind of global mental rearrangement that twelve-step programmes are designed to engineer (Jung, 1933/2010). AA's spiritual approach, evolutionary psychology's inroad in addiction therapy, may, it is hoped, open the way for further therapeutic advances to be made elsewhere in mental health (Galanter, 2008; Miller, 2008).

8.3.1.3 The Value of Pain and the Ethics of Psychopharmacology

The "pain and brain" model of suicide proposed could imply that the organism's homeostatic resolution of emotional pain may not necessarily be facilitated by the use of psychotropic drugs, despite their efficacy in numbing difficult emotions. In the narrow context of suicide prevention, the pain component of suicide's posited "pain and brain" causation would suggest it to be true that a chemical blunting of people's ability to feel emotional pain, or emotions generally, could effectively reduce suicides at a population level (Guzzetta, Tondo, Centorrino, & Baldessarini, 2007).[1] But whether such mass medications are ethically desirable is arguable, for at least two reasons. First, suicide risk not being amenable to prediction at an individual level, it follows that a psychopharmacological approach to treating suicidality would need, to be effective at all, to catch in its net many people who never would have tried to take their own lives anyway: it seems to be the case that many people are being drugged, and having to deal with the side effects of the drugs, in order to suppress the suicidal potential of an unidentifiable few (Carlat, 2010b; Davies, 2013; Maris, 2015). Second, if CMDs are organismic anti-suicide responses to emotional pain, then treatment strategies that seek to suppress the pain, or suppress the CMD symptoms designed to stop that pain translating into suicide, could be expected to have little lasting effect on suicide risk, unless the root cause of both is also dealt with (Michel & Valach, 2001; Mishara & Chagnon, 2011; Pompili, Lester, Leenaars, Tatarelli, & Girardi, 2008). Pompili and colleagues suggest this ineffectiveness is observable: they find that most suicidal patients leave hospital with their psychological pain unaddressed and still suicidal (Pompili et al., 2008; Pompili, Tondo, & Baldessarini, 2005). Worse, the chemical suppression of protective anti-suicide keeper symptoms alone, by antidepressants, may positively aggravate suicide risk (Maris, 2015; Reeves & Ladner, 2010).

A wider ethical dilemma may arise with regard to the general objectives of psychopharmacology; whether the immediate comfort of the recipient is the primary goal, or long-term well-being, the two outcomes potentially calling for different treatment strategies. A comparison of medicine's differential attitudes to physical and mental pain may illustrate the point. It could be regarded as ethically suspect, even unprofessional, if an informed, responsible clinician, when presented with a patient in physical pain, were to view the selection of pain-killers as the primary, or sole, business of the therapeutic consultation (Brand & Yancey, 1993). But essentially this approach could be said increasingly to characterise modern psychiatry: most patient discussions reportedly involve little more than a review of psychotropic medication (Carlat, 2010b; Marcus & Olfson, 2010; Mojtabai & Olfson, 2008, 2010). With regard to physical pain, the appropriate initial response one would expect from a physician is to presume that the pain may indicate a lesion, on which basis it deserves a thorough investigation into its possible origins (Brand & Yancey,

[1] Psychopharmacology may be understood as an exogenous, medically sanctioned analogue, perhaps, to the compulsively self-administered analgesia of emotional pain that, as suggested in Chaps. 4 and 5, may underlie substance addictions.

1993; Wall, 1999). Even then it may be judged therapeutically more prudent *not* to anaesthetise a painful injury to avoid inviting further damage. To illustrate with an example, the excruciating pain that often follows corneal abrasions can be readily relieved with anaesthetic eye drops, but while patients may understandably press clinicians to keep applying local anaesthetic, doing this is known to impede healing and is not recommended treatment (Lowth, 2016). By the same principle, anaesthetising mental distress may well make a patient feel better for now, but at the expense of degrading the effectiveness of what may be a biological, protective signal, and interfering with the organism's natural healing processes. The point has already been touched upon (3.1.2 above) that the working through of psychological pain may often lead to constructive outcomes – deeper insights, wisdom, and the learning of new lessons in life (Bonanno, 2009; Folkman, 1997; Folkman & Moskowitz, 2000; Hein, 2014; Meerwijk & Weiss, 2011; Morse, 2001; Neimeyer, 2000, 2011; Rehnsfeldt & Eriksson, 2004; Zautra, 2014). On this basis, the practice of seeking chemically to blunt patients' difficult emotional conditions, at least without attempting to address their cause, may be ethically questionable (Shattell & Meerwijk, 2012). The prescribing of anxiolytics to ease anxiety, for example, is accepted to be potentially deleterious in certain situations – if taken immediately after bereavements and trauma, they may exacerbate longer-term symptoms and obstruct natural restorative processes (Troisi, 2012). Prescribing anxiolytics in some situations is likened by Bateson, Brilot, and Nettle (2011) to taking the battery out of a smoke alarm as a solution to false alarms – it may seem a good idea, until a real fire occurs. As a general principle, it may be prudent to regard a person's unpleasant emotional state, at least as a provisional working assumption, as likely to exist for good reason.

8.3.1.4 The Subjectivity of Pain

Addressing the cause of emotional pain would seem to constitute the main therapeutic task for tackling both suicide and the keeper psychopathologies that mobilise to avert suicide – pain underlying both, according to this investigation – but that task may not be easy in some respects. Chapter 3, it will be recalled (3.1.2 above), argued that one of the threats emotional pain may have evolved to signal is to the psyche's meaning systems: psychache may warn of attacks to the person's framework of assumptions regarding the benignity and predictability of his world, and his competence to operate in that world (Bolton, 2010). A similar idea of the individual's worldview resurfaced as a survival necessity in Chap. 6 (6.3.2 above) – a paradigm by which the world could be perceived as rewarding place to live and, therefore, willingly inhabited. It was noted that a single item of Popperian disproof could have the potential to pull down the whole life-preserving edifice. The intrinsically subjective nature of such assumptive frameworks could make it very hard for an observer to gauge from the outside the potential threat latent in any particular event or its capacity, therefore, to cause potentially suicidogenic pain. Major social losses, such as bereavements and divorces, may be generally distressing on

average and relatively easy to identify (Brown, 2009), as could so-called PTEs – potentially traumatic events – such as motor crashes and assaults (Norris, 1992). But an individual's subjective experience of these, or any other event, may be complex and influenced by factors unobservable from outside, because the primary threat resides not necessarily in the event itself, but in its ramifications for the individual's personal belief system. Lazarus and Goleman (1979) make the point that a broken shoelace might be catastrophic on account of the proof it provides of the individual's powerlessness, his personal inadequacy, and, as this book could add, the futility of his life's suffering. An apparently trivial setback may be the straw that breaks the camel's back. For others, modally for most people, outwardly severe trauma may be accommodated without great disruption (Bonanno, 2009; Bonanno, Westphal, & Mancini, 2011). The point is worth taking as it may be practically impossible for an observer usefully to judge the proportionality of an individual's reaction to a life event – and whether, referring to a doubtfully useful distinction that has pervaded psychiatry for more than a century, mental illnesses can be ascribed to endogenous or exogenous causes (Lewis, 2009). Instinct blindness prevailing (6.3.2.1 above), not even the person himself may be able to make a fully informed assessment as to why he feels as he feels. An implication of this subjectivity of suffering is that keeper anti-suicide responses may mobilise properly and healthily without necessarily being preceded by a discernibly severe adversity or trauma. The best a therapist may do is to accept the validity of a person's state as presented, try to offer non-judgemental empathy, and seek to help the person find his own solutions to his own experience of pain (Orbach, 2011; Rogers, 1980; Shneidman, 2001, 2005).

8.3.1.5 The Restorative Effect of Therapeutic Relationships and Placebo

While it may be very difficult for a therapist reliably to pinpoint the source of a person's mental pain, this uncertainty does not have to be a cause for despondency: two dynamics that have emerged in this book would suggest that it should not be difficult in many or most situations to help people find relief from their emotional pain, with or without detailed knowledge of the pain's origins.

First, it has been argued that pain is generally adaptive: it indicates an unmet biological need (Wall, 1979). Emotional pain likely points to a need that is social in some form: the point was explored in Chap. 3 that emotional pain may be largely, and perhaps the same things as, social pain (MacDonald & Leary, 2005; Thornhill & Thornhill, 1989). Even physical pain may have a social component: chronic pain is a biopsycho*social* phenomenon, so argue Gatchel, Peng, Peters, Fuchs, and Turk (2007). The CMD symptoms that are posited to activate as keeper anti-suicide responses to this social pain would be expected to be associated with precipitating social losses, as indeed seems the case (Harris, 2000). The encouraging corollary is that social pain may expectably be relieved by almost any intervention that engages the person in a supportive, empathic relationship – such as that between client and psychotherapist (Kahn, 1997; O'Brien & Houston, 2002). It may be through this

general dynamic that most therapies,[2] largely independently of their theoretical underpinnings, seem to help people feel better, as far as conclusions can be drawn from the empirical research (Westen, Novotny, & Thompson-Brenner, 2004). The restorative effect simply of being in receipt of support, almost any support, might equally explain much of the effectiveness of psychiatric drugs – the tangible evidence of the drugs themselves, perhaps accentuated by discernible side-effects, signalling that help has arrived (Carlat, 2010a; Davies, 2013). Menninger (1963, p. 278) makes the point well when he says a "cup of water may start a process of recovery not through correcting dehydration, but because the giving of a cup of water may have a powerful symbolic effect." The bind described by Carlat (2010b) is that, as a specialist psychopharmacologist, in order to activate the placebo, he is obliged to prescribe active psychotropic drugs, with the disadvantage that these carry stronger side effects. Davies (2013), however, argues that it may be precisely these side effects that activate the placebo: the design of supposedly "blind" controlled trials favours substances with discernible side effects, because the side effects serve to alert trial subjects that they are receiving the "active" substance as opposed to the inert sugar pill of the control group. It appears that placebo accounts for much, perhaps most, of the beneficial effects of common psychiatric drugs – three quarters of the effect of a tranche of new antidepressants, according to a meta-review cited by Carlat (2010a).

Secondly, the homeostasis of affect discussed in Chap. 6 (6.3.1.1 above) implies that, from a position of low SWB, almost any supportive intervention could be expected to speed the organism's return to a resting point (Cummins, 2013). This expectation echoes Carl Rogers's faith in an actualising tendency: an innate force that can be relied upon to bring about psychotherapeutic change given conducive conditions – centrally, the experiencing of another human being's empathy, unconditional positive regard, and transparent congruence (Rogers, 1940, 1946, 1980). In other words, a therapeutic intervention may be effective not so much by doing the healing but, perhaps less ambitiously, by helping to put in place the conditions by which the organism can heal itself.

8.3.2 Restricting Access to Lethal Means of Suicide

While it may be important anyway on compassionate grounds to help people find relief from emotional pain and from the CMD symptoms posited to respond to that pain, such help would probably not be an efficient strategy for reducing suicides specifically, because only a very small and unidentifiable minority of those so helped would be expected to be at risk of suicide anyway, according to the evolutionary model proposed here. The organism's own evolved defences would already have exploited whatever usefully predictive cues are available to forestall those suicides that could be so forestalled. This analysis would, however, add theoretical

[2] But not all (Lilienfeld, 2007).

support to the strongly evidenced argument that interventions which restrict the means of suicide can be effective and efficient as preventative strategies (Barber & Miller, 2014; Gunnell & Miller, 2010; Mann et al., 2005; Yip et al., 2012). The model suggests that, working in sympathy with the organism's own defensive systems, interventions that add even marginally to (a) the intellectual challenge, and/or (b) the time, and/or (c) the surmounting of moral obstacles, required for a suicidal act to be organised may be expected to have protective results. Addressing each of these respectively, three dynamics arising from the model, possibly operating in concert, could be relevant and will be discussed in turn: the third of these, involving moral issues and the suicide taboo, is presented in its own section (8.3.3 below).

8.3.2.1 Means Restriction Capitalising on Brain-Type Keeper Defences

First, the impact of means-limiting suicide prevention measures may be best understood from the unusual perspective of someone in the grip of brain-type keeper defences. It was argued in Chap. 4 (4.5.2 above) that people in extreme and chronic emotional distress, under the influence of an activated brain-type keeper, would expectably find it hard to devise and enact complex plans of any kind, suicide attempts included. To someone who is confused and finding it difficult to take decisions, even a minor added complication – such as finding netting installed on a preferred jump site or drugs sold only in small pack sizes – could be sufficient to make a suicide project impracticable, at least for the time being. An extra cognitive challenge, added at a point when the individual may not be thinking clearly, could at least improve the prospects of an attempt being survivable. The general public might be understandably sceptical: observers, assessing such apparently imperfect obstacles as jump nets and small retail drug packs with the benefit of normal cognitive functioning, might presume a determined suicide attempter would behave as a person normally might and find ways around them. Public resistance to means restriction measures is commonly encountered from this position of anticipating, mistakenly, if not unreasonably, that they would not work (Joiner, 2010; Miller, 2013; Miller, Azrael, & Hemenway, 2006). It might help in such public debates for advocates of means restriction to have an added theoretical argument, proposed here.

8.3.2.2 Means Restriction Capitalising on Pain-Type Fender Defences

Second, the homeostasis of SWB at above neutral, proposed in Chap. 6 as a pain-type fender (6.3.1.1 above) – a system posited to keep the individual at a safe distance from suicidogenic negative affect – would be anticipated to work rapidly at a time of emotional crisis to restore affect to its positive resting point (Proudfit, Dunning, Foti, & Weinberg, 2014). Suicidal states would be expectably transient, a theoretical prediction upheld by the empirical evidence: suicidal crises appear to precipitate quickly (Eddleston et al., 2006; Millner, Lee, & Nock, 2017) and dissipate often in a matter of days, hours, and even minutes (Drum, Brownson,

Denmark, & Smith, 2009; Hawton, 2007). On this basis, if a sufficient obstacle is raised to deal with the immediate risk, as the previous paragraph described, the organism's own pain-type anti-suicide defences may be expected to keep a person safe thereafter. The short-lived nature of suicidal states suggests that means restriction programmes need simply to buy time to be successful (Chen, Chien-Chang Wu, & Yip, 2011; Eddleston et al., 2006) and would explain why the benefits may not be cancelled out by compensatory increases in substitutional attempts (Barber & Miller, 2014; Daigle, 2005; Gunnell & Miller, 2010; Yip et al., 2012).

8.3.3 Means Restriction Capitalising on Brain-Type Fender Defences

If it is the case, as Chap. 7 argued, that powerful cultural proscriptions against suicide may be assimilated by the individual – brain-type fender systems that effectively deny the means of suicide as a viable or even thinkable option, including to those who may be motivated to escape pain – then these defences may conceptually present a further opportunity for means restriction interventions. Reminders that suicide is not a socially sanctioned behaviour could be expected to have particular salience at popular locations for suicide – the mere sight, perhaps, of telephones installed on the Golden Gate Bridge or challenges made by passing highway patrols (Miller, 2013).

A broader question surrounds the effects, intended or otherwise, of policies that may modulate the signals of social disapproval registered by potential suicides. The suicide taboo, almost universal across human cultures (Colt, 1991; Fedden, 1938), no doubt brings its own problems. The difficulty many people have talking about suicide may deter people at risk from seeking help and impede potentially life-saving conversations between patients and their carers (Bruffaerts et al., 2012; Menninger, 1938; WHO, 2014). The socially detaching effect of the suicide stigma can be deeply distressing for bereaved survivors (Cvinar, 2005; Grad, 2011; Hanschmidt, Lehnig, Riedel-Heller, & Kersting, 2016). Some clinicians reason, on this basis, that more should be done to make people feel easier about discussing suicide and to encourage a more empathic acceptance of suicidality as a problem (Linehan, 2006, 2011). It may be that promoting a greater frankness (Gould et al., 2005), and the lifting of official disapprobation (Mishara & Weisstub, 2016), may not necessarily make suicides more likely.

On the other hand, if such measures contribute to a weakening of the suicide taboo in a community group, then the unintended consequences may potentially be grave. If, as Chap. 7 proposed (7.2.1 above), the suicide taboo has evolved by a cultural form of natural selection because of its effectiveness in suppressing suicidal urges among those motivated to take their own lives, then suicide prevention may be conceivably made harder, not easier, by policies aimed at making suicide a more comfortable topic to talk about. Once the taboo is lost, it may be exceptionally difficult, practically and ethically, to re-establish it (Hezel, 1989; Kral, 1994;

Mishara, 2016). C. J.-H. Macdonald (2007) suggests that the acceptability of suicide may propagate in a community as a lethal wave that may take many generations to run its course. Illustrative of the difficulty of halting such a wave is the continuing search for solutions to an ongoing epidemic of self-murder among young people in Micronesia (Booth, 1998; Hezel, 1980; Rubinstein, 2002): out of compassionate motives, as a radical intervention to make suicide unacceptable again, to make the now thinkable unthinkable, the diocese's Roman Catholic bishop proposed the withdrawal of burial honours for suicides – denying church rites or public prayers – specifically to signal society's disapproval (Hezel, 1989). There was no suggestion of going as far as the measures taken by previous generations – no medieval degradations of corpses, as Hezel (1989) stresses; but the difference between the bishop's proposal and the punishment of suicides found in human cultures across the centuries (Fedden, 1938) might be viewed nonetheless as a matter of degree, not kind – the intent may be the same. To return to Alvarez's (1971) question as to why so private an act as suicide attracts such public hostility, it may be that some hostility is protective, particularly for a society's most psychologically vulnerable members. Moral assumptions about suicide probably have to be instilled at a young age to have a prophylactic effect (Pokorny, 1992; Macdonald, 2007). It is possible that, at an impressionable time of life, relaxed, non-judgemental talk about suicide, while apparently innocuous, may have culturally infectious and lethal side effects. Public health initiatives to restrict cognitive access to the means of suicide may do well to leave alone, or perhaps nurture, a cultural disapprobation — that suicide is not "cool" (Mishara, 2016).

8.4 Suicidology May Itself Be Affected by the Suicide Taboo

If the conclusions of this book are broadly correct, that the evolution of suicide and the evolution of defences against suicide may explain many commonplace features of human cognition and behaviour, the question might reasonably be asked why a similar theoretical framework is apparently not already circulating in the research community.[3] No new empirical information has been put forward: this book draws on mainstream bodies of knowledge, none of which would appear to be contentious.

[3] There are precedents for some components of the model proposed in this book. In particular, Himmelhoch (1988) authored a paper asking "What destroys our restraints against suicide?" while Hundert (1992) wrote of "The brain's capacity to form delusions as an evolutionary strategy for survival." Neither provides an evolutionary account of why and how such restraints and strategies would have evolved or their implications. Humphrey (2018) infers that defences against suicide would have evolved but expects them to be primarily cultural – brain-type fenders, by this book's terminology. The gist of several key proposals in this book, and then a draft PhD thesis, were presented by the author with the aid of a poster at a 2016 international suicidology conference (Soper, 2016).

None of its theoretical foundations would seem to be radical either.[4] All that this investigation has sought to do is to piece together the facts of suicide's epidemiology and connected domains as they relate to the main theoretical tenets of evolutionary biology. This would not in itself seem to be a difficult task. Needing only a basic grasp of evolutionary theory, and access to others' research, it is the kind of project that ought to be within the capability of an amateur scientist (Wilson, 2007).

On the other hand, the analysis suggests that the topic of the evolution of suicide may lie obscured in the overlapping shadows of two intrinsically hard-to-think domains – thoughts that researchers, as human beings, may naturally find awkward or unpleasant to contemplate or discuss. Specifically, it may be that evolutionists do not like to think about suicide; and suicidologists may not like to think about evolution – or, at least, evolution as it pertains to suicidality. Progress in any field of research presumably rests in part on researchers' readiness to think about and confer about their ideas: if the ideas involved are intrinsically inconceivable, and unspeakable, then progress may understandably be slow.

8.4.1 Evolutionists May Not Like to Think About Suicide

Chapter 7 proposed that a culturally transmitted taboo against the idea of suicide, combined with an evolved predisposition for humans to adopt a moral disgust at the idea of suicide, may combine powerfully for the protective purpose of making it hard for people to think about taking their own lives. This social reticence apparently being a widespread, if not a virtually universal, feature of our species (Alvarez, 1971; Colt, 1991; Fedden, 1938), it would not be surprising to find the same defensive machinery also impacting on the way suicide is thought and talked about – or, rather, not thought or talked about – in scientific settings too.

Use of the so-called C-word may illustrate how an anti-suicide cultural ethos can pervade scientific circles. Although suicide is no longer a criminal offence in most countries of the world, and despite a widespread public health commitment to destigmatise the topic, the word "commit," as in "commit suicide," routinely appears in research literature, the word bringing with it presumably unintended connotations of illegality, immorality, and dishonour (Beaton, Forster, & Maple, 2013; Nielsen, Padmanathan, & Knipe, 2016; Silverman, 2006). As another possible illustration, Gorelik and Shackelford (2017) point to the moralistic fallacy – researchers making the leap from "ought" to "is," arguably conflating suicide's moral undesirability with assumptions about its dysfunctional origins – which they observe in one of the (very few) recently published papers that touch on the subject of suicide's evolution.[5]

[4] As an exception, perhaps, the idea of cultural evolution, touched upon in Chap. 7 in the context of the suicide taboo, may be contentious. Not all evolutionists may be comfortable with the principle that nearly universal cultural ideas might spread through a process of group selection (Tooby & Cosmides, 1992), although even here a rapprochement between schools appears to have emerged (Wilson & Wilson, 2007).

[5] It is possible that this volume too is unwittingly affected by similar subjectivity.

As a society-wide phenomenon, the suicide taboo is likely to influence not only researchers but workers in the ancillary services on which suicide research relies, including publishers, funders, and course schedulers. Sharing an anecdote of his experience with publishers, Joiner (2005) recounts that the editors of a university magazine who ran a story about his suicide research were loath to feature it on the cover, on the grounds that suicide was not an appropriate topic for the front page. Financiers of research may be as reticent: Linehan (2006) finds that, despite the gravity and scale of suicide as a public health problem, the domain receives only a small fraction of the research funding and attention assigned to less lethal but probably more palatable psychopathologies. Psychology, the mainstream academic domain perhaps most closely linked to suicidology, gives the impression that suicide is not an acceptable topic to study, according to J. R. Rogers (2001). The extraordinary impact suicide has in human affairs, taking more lives than war, murder, terrorist attacks, accidents, and all other forms of violent death put together (WHO, 2014), would indeed be hard to guess from the cursory treatment given to the topic in the main general psychology texts, at least one of which (Kalat, 2017 - *Introduction to Psychology*, 608 pp) deems suicide to be unworthy of inclusion in its subject index.

This structural neglect of suicide as a research topic is probably in part self-perpetuating. While suicidology itself is grappling with a weak theoretical base (Joiner, 2000; Lester, 2000), conventional psychology theories ignore the subject altogether (Rogers, 2001). And yet, as Holmes (2011) notes, suicide is so strange an idea to most people that a theoretical framework is a prerequisite for thinking about it. So the taboo, it appears, makes suicide theory both necessary and, at the same time, difficult to formulate: the outcome is that suicide research may be trapped in a circular, theory-deficient backwater.

If the taboo on suicide is strong enough seriously to impede the work even of suicidologists, then it is understandable that suicide has rarely reached the top of the research priorities of evolutionary psychologists. Even so, in view of the breadth of material that could be examined, it is remarkable that, at the time of writing, a search of library catalogues suggests that only one book dedicated substantially to the evolution of suicide (deCatanzaro, 1981) may have been published.

8.4.2 Suicidologists May Not like to Think About Evolution

Compounding the problem, suicidology may be hampered by the reality that evolution, too, is a topic that many people seem to have difficulty thinking about, a discomfort that affects both lay and academic communities. Four in ten Americans, despite overwhelming scientific evidence, continue to prefer the idea that God created humans in their present form 10,000 years ago, an adherence to creationism that has changed little over several decades (Newport, 2014). Even among US college students, half view evolution as “just a theory” and half the remainder are outright creationists (Newport, 2014).

This book suggests that a powerful, self-protective psychological motivation may underlie this resistance to evolutionary thinking. It was argued in Chap. 6 (6.3.2 above) that human beings, alive only because they choose to be, tolerate the pains of living only on the condition of receiving enough pleasurable experiences to make life affectively worthwhile. It was argued that there may be little or nothing in the Darwinian struggle for existence sufficient to sustain the required sense of subjective well-being; hence, the need arises for humans to hold in the mind benign, usually divinely ordered, virtual realities. The motivation to defend these models of self-in-the-world from factual disproof is extreme: at stake is the individual's mental health and, ultimately, survival. Many peoples' worldviews may necessarily rely on communally defended religious belief systems. Reconstructing what may be life-sustaining paradigms in a way that can accommodate the tenets of natural selection may be too great a challenge for many people, or too big a risk, especially for non-scientists. It ought to be no surprise that many find the idea of an amoral universe and a human species built by blind forces deeply disturbing. In the experience of the evolutionary biologist Maynard Smith (1990), picking up on one of Dawkins's (1976) metaphors, "most people do not want to see themselves as lumbering robots programmed to ensure the survival of their genes." Dawkins (2003, p. 9) illustrates the sentiment with George Bernard Shaw's visceral objection to natural selection:

> When its whole significance dawns on you, your heart sinks into a heap of sand within you. There is a hideous fatalism about it, a ghastly and damnable reduction of beauty and intelligence, of strength and purpose, of honour and aspiration.

Creationist thinking, likely fuelled by this sense of dread, prevails even in academic circles to the extent that, according to Dawkins (2006), many scientists are too frightened to "come out" as non-believers.

On this basis, it would be fair to expect that not all suicidologists are openly enthusiastic Darwinists either. Indeed, working at close quarters with death and despair as they must, suicidologists may have a stronger psychological motive than most for keeping their distance from evolutionary ideas: just thinking about death seems to make people more likely to prefer a creationist stance (Tracy, Hart, & Martens, 2011). Many suicidologists who do accept the facts of evolution may reasonably prefer not to concern themselves greatly about its possible relevance to their work. Not surprisingly, perhaps, as Brown et al. (2009) observe, evolutionary psychology is largely ignored in suicide research.

8.4.3 The Evolution of Happiness

If suicidologists do not like to think about evolution, and evolutionists do not like to think about suicide, the flow of ideas blocked in both directions, then the study of the ultimate origins of suicide, arguably one of the most important features of the human condition (Camus, 1955; Maris, 1981), may fall between the two stools. An invitation might be extended to researchers working from either intellectual base to consider if more could be done, to examine more critically the implications of

evolution theory as applied to this uniquely human behaviour. Such a line of thinking may not turn out to be as bleak as it may initially seem.

Researchers may find, on reflection, a surprisingly affirming message in the evolution of suicide. This book suggests that emergence of the capacity for intentional self-killing may have marked a significant discontinuity in the evolution of life on earth, a point at which the rules of natural selection subtly changed. To qualify an assertion made by Kirkpatrick and Navarrete (2006, p. 291) that "natural selection is not in the business of building happy organisms," nature might have been forced into that business in recent times, having created an animal so sentient that its active consent is required for its continued survival (Baechler, 1975/1979). A phylogenetic analogy of the bargaining hypothesis of suicide (Syme, Garfield, & Hagen, 2016) discussed in Chap. 1 (1.3.3 above) may have played itself out over an evolutionary timescale: faced with the fitness threat of suicide, natural selection may have been obliged to provide humans with compensations for continued suffering, a payoff in the form of the impulse to feel, and to express, joy, love, hope, fulfilment, well-being, meaning, and a sense that life is worth living. The bargain our ancestors struck with nature was negotiated over the course of millennia from a position of strength, because generations of humans have exercised their power to say, "If this is life, I don't want it." The prize, contrary to Shaw's dismal vision of Darwinism and in defiance of nature's otherwise algorithmic meaninglessness, is our essential human privilege to appreciate beauty, purpose, honour, and any other values we may deem worthy to live by. Equipped with the impulse to give of ourselves unselfishly and unconditionally, we may be, in Desmond Tutu's (2010) phrase, "made for goodness." The outcome of the evolution of suicide is that, for most of us, most of the time, life is good.

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